the Tool Engineer

FEBRUARY 1956

nonsticking plug

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

3 WAYS *to get greater precision and*

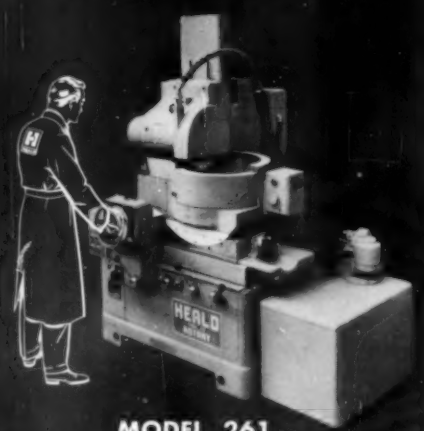
HIGHER EFFICIENCY

in rotary surface grinding...

new MODEL 161

SMALL SIZE WORK

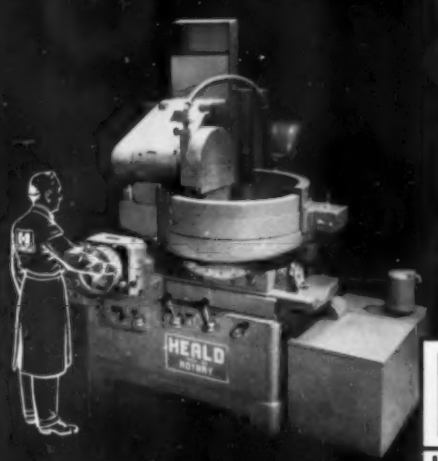
This compact, low-cost machine with 6″ magnetic chuck grinds flat, concave or convex surfaces to extremely low microinch finish. Features include rigid, column type construction, manual or power reciprocation, simple mechanical reversal, "right-hand" operation and powerful direct-drive wheelhead. For complete information, send for Bulletin 1-161.



MODEL 261

MEDIUM SIZE WORK

Available with 12″ or 16″ rotating chuck, this heavy-duty machine does high precision surface grinding on a wide range of small to medium-size work. Smooth, hydraulic operation of wheelslide and table reciprocation can be arranged for manual or fully automatic control. Vertical column construction places wheel pressure directly over table ways for maximum rigidity of support. Grinds flat, convex or concave surfaces. Bulletin 1-261 gives complete details.



new MODEL 361

LARGE SIZE WORK

A massive, heavy-duty machine with 24″ rotating chuck for precision grinding of flat, convex or concave surfaces on large, heavy work. Available with either manual or fully automatic control. Heavy, rugged base and column construction, with smooth, infinitely variable hydraulic feeds, assures freedom from chatter and vibration. Hydraulic power unit with multiple pump system provides separate lubrication pressure and operating pressure. For further details, send for Bulletin 2-361-T.

Three more reasons why IT PAYS TO COME TO HEALD.

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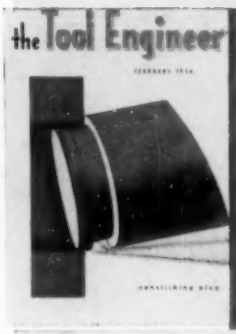
COVER: Sticking of engaging rings and pins has long been a problem. Basic investigation has resulted in a set of formulas that, when correctly applied, will give nonsticking rings and plugs. Formulas are given and their use is explained in the article starting on page 111.



The Tool Engineer

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PLANNING · ENGINEERING · CONTROL · TOOLING · EQUIPMENT · PRODUCTION

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The Tool Engineer

Today's Developments Shape the Future

Manufacturing costs are assuming increasing importance in the tightening noose of competition. As a result many companies, both large and small, are becoming aware of the necessity of engineered production. For instance, in the last three years one of the country's largest corporations has established a unified manufacturing engineering organization with emphasis on process development. Almost daily, new facilities are being built for manufacturing research. Also, many old-line firms are quietly revamping their manufacturing line-up to meet the challenge of this dynamic era.

These signs hail a significant trend. A greater transformation has occurred in manufacturing philosophy in the past five to eight years than in the previous fifty. This is reflected in a remarkable progression of improvements in tooling, machines, materials handling methods, plant layout and production processes. No company, in looking to the future, can afford to ignore these events.

This background also explains the injection of a new voice into top executive councils. Manufacturing is now conceived as an engineering job of the same importance as that of product design and of equal or even greater magnitude. In decisions involving product design, the tool engineer must be consulted to facilitate guiding production through to final packaging.

Accountants, purchasing agents and salesmen can hardly be trusted with executive responsibility for making manufacturing decisions. Stakes are high—the entire future of the company may be compromised by a single wrong decision. A persistent question that might be cited is when to automate—and how much.

This shift in viewpoint and the increasing importance of the technology of production is vitally affecting the status of the tool engineer. Manufacturing engineering has advanced as far beyond the scope of the old master mechanic as the tape-controlled planer mill has advanced beyond Eli Whitney's milling machine. The future belongs to those who prepare for it. This applies with equal force to individuals and corporations.

Ralph H. Eshelman

Associate Editor.

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for
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This new type Adjustable Setting Master eliminates the need to stock a master ring gage for every size hole to be inspected. Settings which are the equivalent of X and even XX accuracy ring gages are easily accomplished when proper considerations to temperature are made. Unique "rotation" design takes weight off movable anvil when setting to gage blocks, and off the V-block when it is being adjusted to the bore gage centralizing plungers.

Write for Details

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2. Master is rotated to proper position for use.

3. Bore gage is set to master after V-block is adjusted to centralizing plungers.

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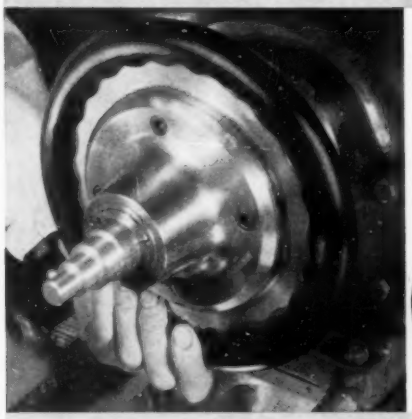
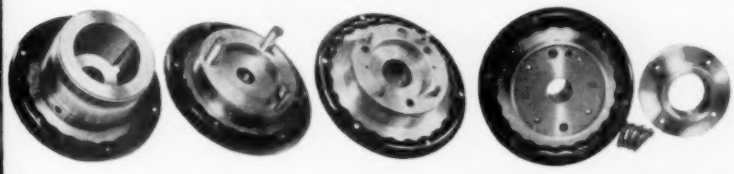
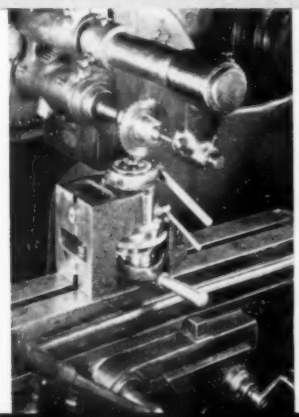


HARDINGE-SJOGREN SPEED Collet Chucks

Increase machine capacity 25% to 40% with the fast action of a handwheel-operated HARDINGE-SJOGREN Speed Collet Chuck. Let your operators get the full use of your tool room lathes, engine lathes and grinders.

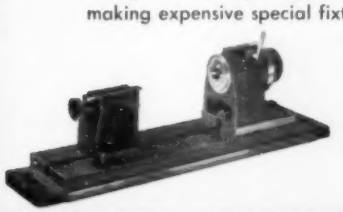
Five sizes: 1", 1 3/8", 1 3/4", 2 1/4", and 3 1/2" Collet Capacity; Threaded, Tapered Key-Drive, Cam-Lock, and American Standard Spindles



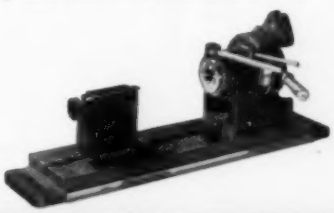


HARDINGE COLLET INDEX FIXTURES

The way to increased production is to hold work accurately and provide for rapid indexing. HARDINGE Collet Index Fixtures—H-4 for Tool Room and Inspection Departments; HV-4 for Production Departments—will help increase production on either new or old machines. Planned interchangeability for a variety of applications. Buy these standard fixtures instead of making expensive special fixtures



H-4



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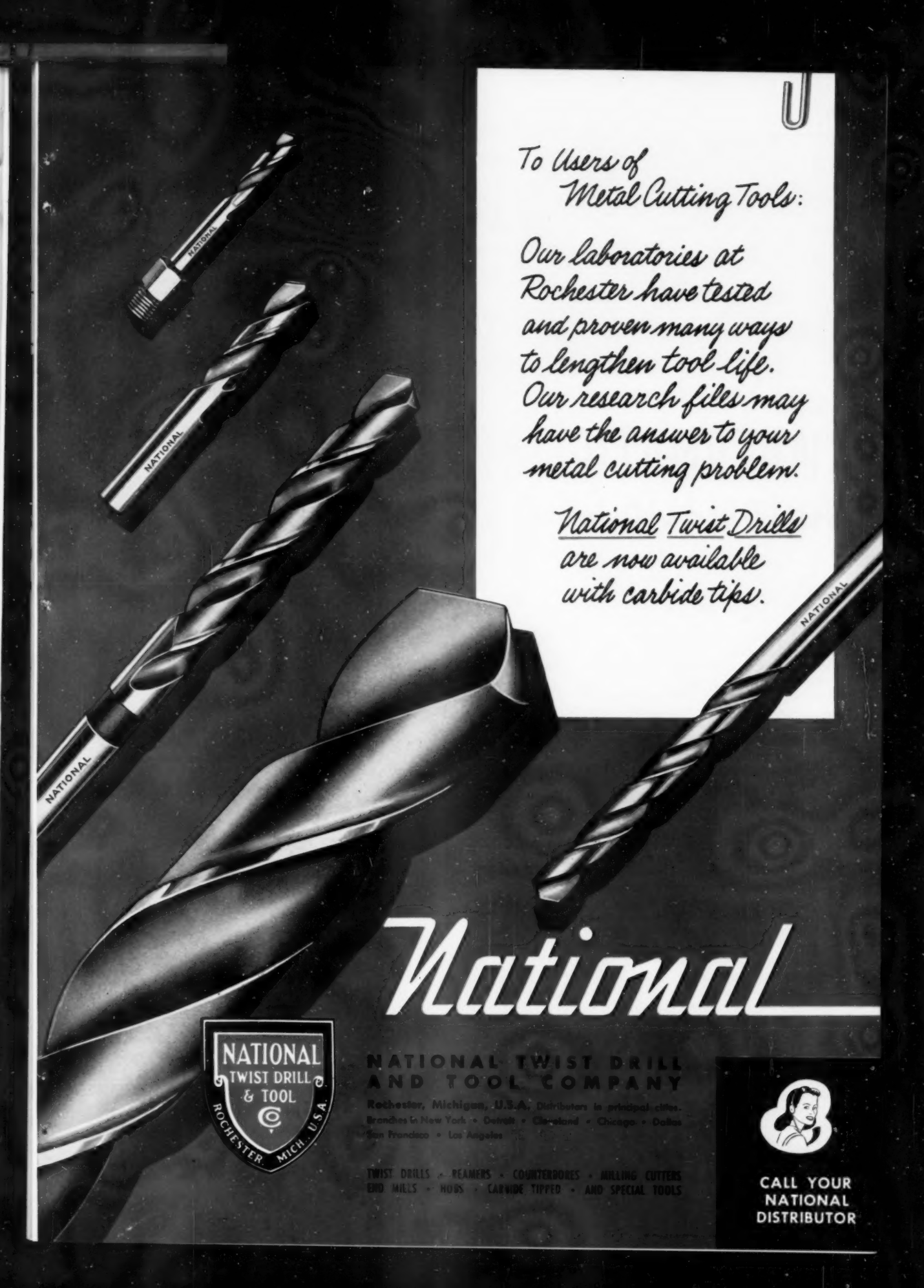
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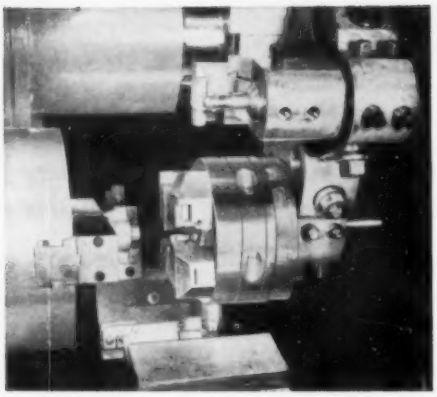


"AUTOMATIC THREADING" for Automatic Chucking Machines

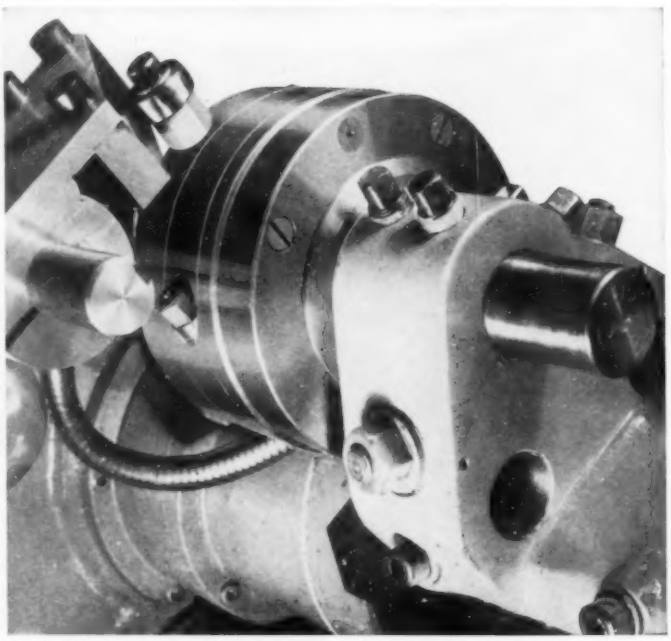
The adaptability of Landis Heads is once again proven by this application of a LANDMATIC Head on a #1AC Warner & Swasey Automatic Chucking Machine. Normally, the LANDMATIC is applied to turret lathes and while self-opening, it is closed manually. To adapt this stationary head for automatic operation on the Automatic Chucking Machine, only two steps were required: (1) —the addition of a closing roller in place of the handle and (2) —the use of special closing pins which provide overtravel, eliminating the need of a complicated, accurately-set closing cam.

This adaptability has paid off for the S&C Electric Company, Chicago, Illinois, manufacturers of high voltage protective equipment.

Besides a completely automatic threading operation, this head, through the use of long life tangential chasers, offers lower tool cost and less down time. For example—when threading the workpiece shown, a contact ferrule of 85-5-5-5 cast red brass requiring a 1⅜"—16 Pitch UN thread ⅜" long into a 1/16" relief, complete runs of over 3000 pieces are made without grinding the chasers.

Another outstanding feature of LANDMATIC Heat-Treated Heads is their wide range coverage and oversize capacity. The 2" Head, illustrated here, will normally thread all diameters ranging from ⅜" to 2". Using oversize chaser holders, its range can be increased to thread up to 3¾" in diameter.

For more complete information on LANDIS Heat-Treated Heads for rotary or stationary applications, straight or tapered threading, ask for Bulletin F-90. Please send specifications when writing.



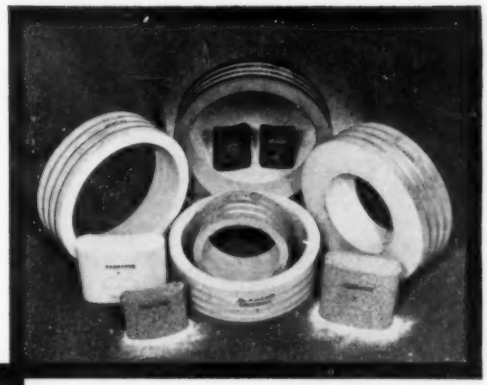
LANDIS *Machine* CO. WAYNESBORO PENNA., U.S.A.

384

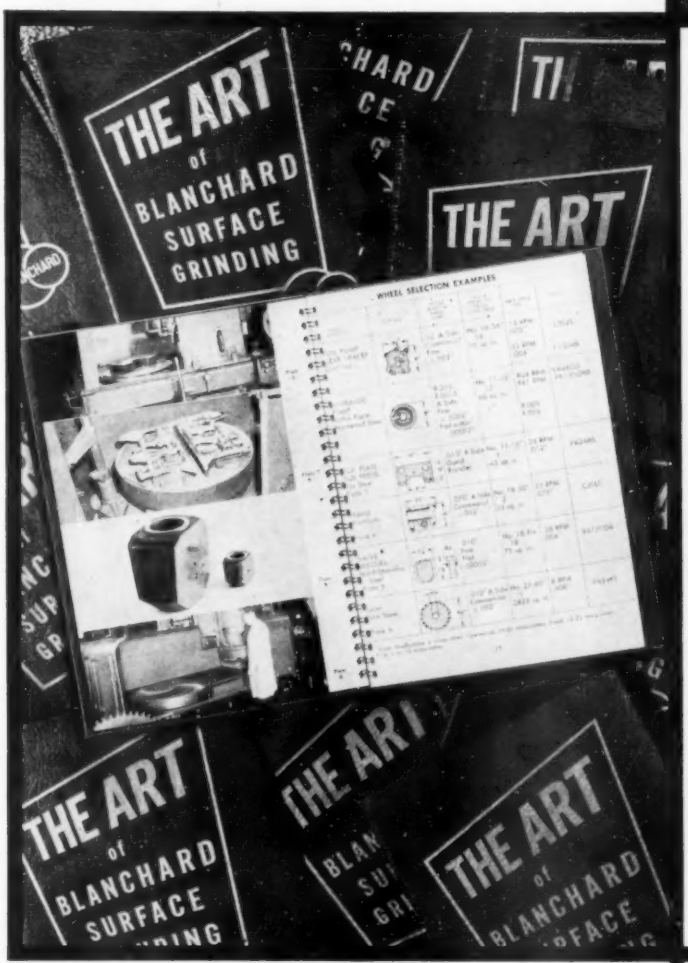
FREE!

Page after page shows the correct abrasive wheel to use

(for the best Blanchard grinding results)



Blanchard wheels in silicate, resinoid and vitrified bonds.


THE ART of BLANCHARD SURFACE GRINDING
THE ART
WHEEL SELECTION EXAMPLES
THE ART of BLANCHARD SURFACE
THE ART of BLANCHARD

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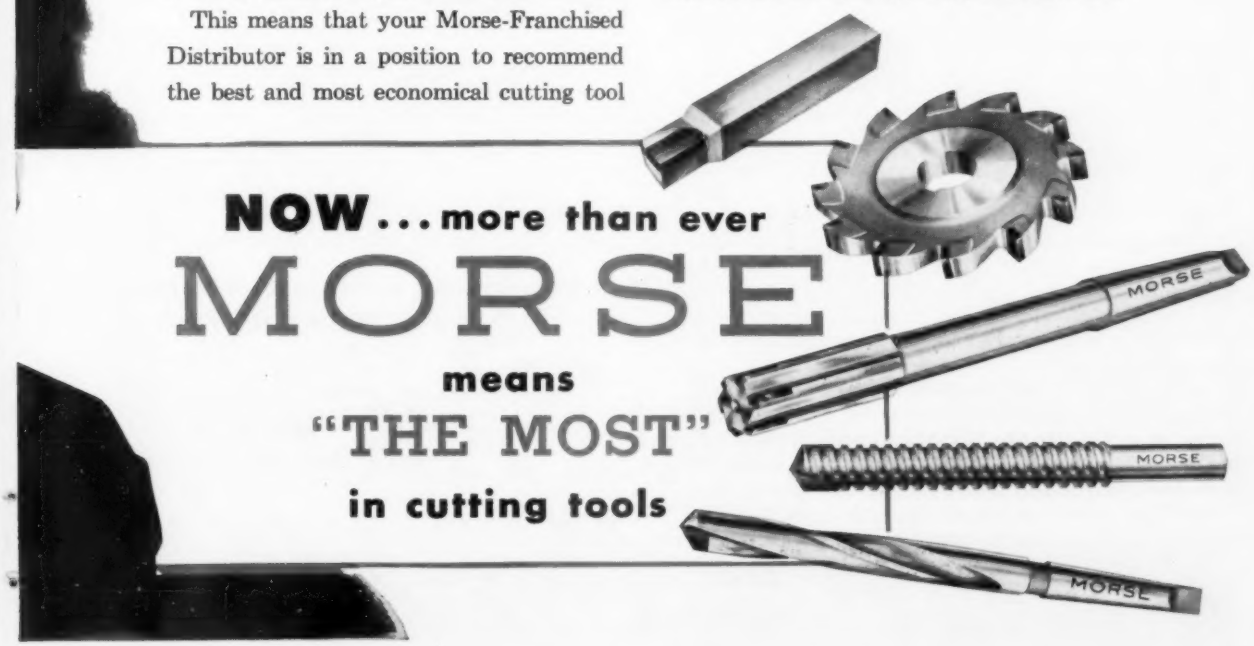

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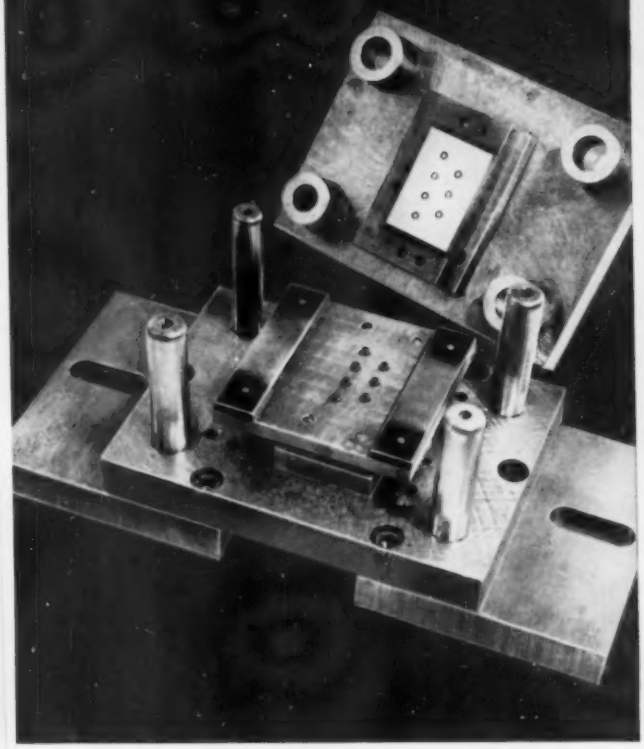
FIELD REPORT: NO. 87



WHICH DIE STEEL WOULD YOU USE HERE to boost production per grind 500%?

These tools blank out dead soft brass washers, .170" O.D. x .100" I.D., .009" thick, on a punch press at 186 strokes per minute. It is an exacting job for a couple of reasons. First, it involves a government contract and strict delivery schedules have to be maintained. Then too, the punch and die are set up to blank seven washers per stroke and have to do this for many millions of pieces . . . and still remain within burr limitations set up by the government. Performance from the steel used in the past was far from satisfactory . . . to maintain schedules, production had to be substantially increased.

Suppose the decision were up to you. Which die steel would you be willing to recommend for steady, trouble-free production?

In this Field Report from customer files, here's what happened: The Carpenter Matched Set Diagram was consulted and Carpenter No. 610 (Air-Wear) was selected. Since then No. 610 has enabled the Company to hold delivery schedules comfortably . . . racking up increases in production per grind as high as 500%. And this is especially significant when you realize that five hours' downtime is involved each time the tools have to be reground. Total parts to date: 5,500,000 . . . and the tool is still good for about 15 regrinds of .003" each.

Why make the tough decisions alone, when Carpenter's service organization is sincerely interested and equipped to work with you? A move in the right direction would be to call your nearest Carpenter Mill-Branch Warehouse, Office, or Distributor, now. *The Carpenter Steel Co., 154 W. Bern St., Reading, Pa.*

Your toolroom can use Carpenter Matched Tool and Die Steels to:

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Boost output per grind
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Seeing was believing for a group of mechanical officials from one of the mid-west's most prominent earth moving equipment builders.

Frankly they just wouldn't believe that the new 32" "AMERICAN" Pacemaker Lathe would effectively use 60 horse power and cemented carbide cutting tools in machining rough alloy steel forgings. So they came to see for themselves and they saw:

1. Cuts 1⅛" deep.
2. Cutting speed 300 feet per minute.
3. .030" feed.
4. 60 to 65 horse power registered by horse power meter during the maximum cuts.
5. Not a shimmy or whimper from the machine.

They were amazed and convinced.

This new model Pacemaker is endowed with the power, stamina and convenience that combine to produce a thoroughly dependable and highly productive unit.

Bulletin No. 44 tells all . . . have one?

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

the finest high production lathes

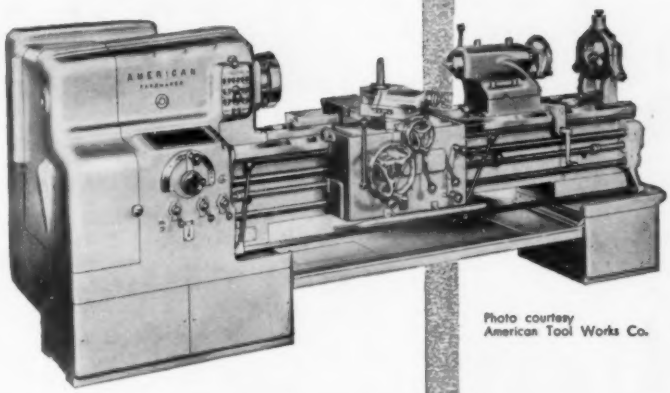
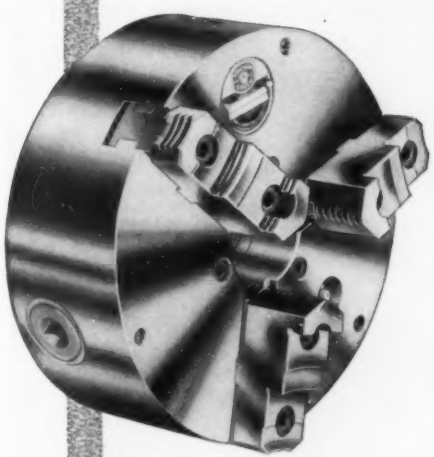


Photo courtesy
American Tool Works Co.

Here is the new 16" DeLuxe Model "AMERICAN" Pacemaker Lathe. This new design places particular emphasis upon the factors of power, stamina, dependability, precision, accuracy and ease of operation required for both production and tool room service. For complete data write for Bulletin No. 116, The American Tool Works Co., Cincinnati 2, Ohio.

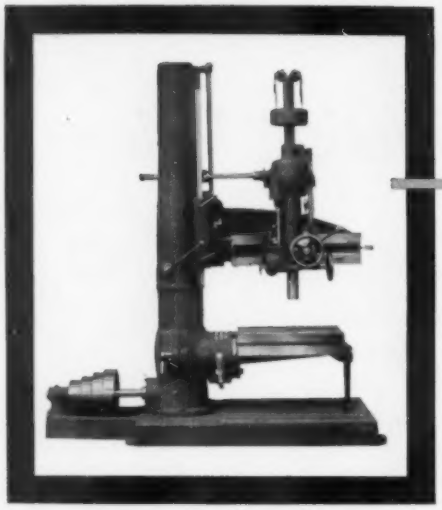
deserve the finest high production chucks

This is Horton's 3-Jaw Scroll Universal Chuck which for more than 100 years has been the companion to the world's finest lathes. Its lasting accuracy and precision contribute to the high production of any tool room or plant. For the complete story on this and Horton's complete line of high production chucks, see the Horton people in your area now.



HORTON
Since 1851
CHUCK

WINDSOR LOCKS, CONN.



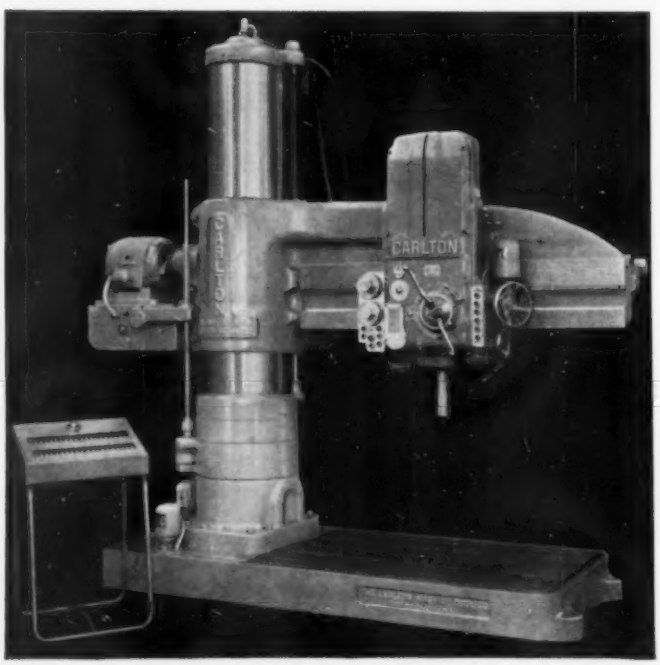
CARLTON	1916 Style D	1956 Model 4A
Speeds, number	4	36
Speeds, maximum, rpm	450	2000
Feeds, number	1	18
Main drive motor, hp	line shaft	25
Bearings, type	plain	anti-friction
Lubrication	manual	automatic
Spindle diameter at point of drive	$15/16$"	4"
Vertical travel of spindle	8"	20"
Traverse of head on arm	40"	59"
Traverse of arm on column	32"	44"
Shipping weight, lbs.	3000	26,335

Carlton RADIAL DRILLS

continuously improved since 1916 . . .

better than ever today . . . now available with

pre-selector and programming device



The belt driven Style D Carlton radial drill (above)—an advanced design model when introduced in 1916—looks pretty old-fashioned today.

And indeed it is. For Carlton radial drills today are ever so much faster and more powerful. And thanks to two sensational developments, Carlton radial drills are now better than ever:

Programming—for pre-selecting speeds and feeds for an entire drilling program including as many as 20 or 30 operations.

Pre-Selector—for setting speed and feed for the next operation while machine is still under cut.

For a revealing radial drill demonstration, ask your Carlton distributor to arrange a showing of the new Carlton programming film. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

VERSATILE

MILL-M-MATIC for Accurate, Heavy Duty Production Milling . . . .

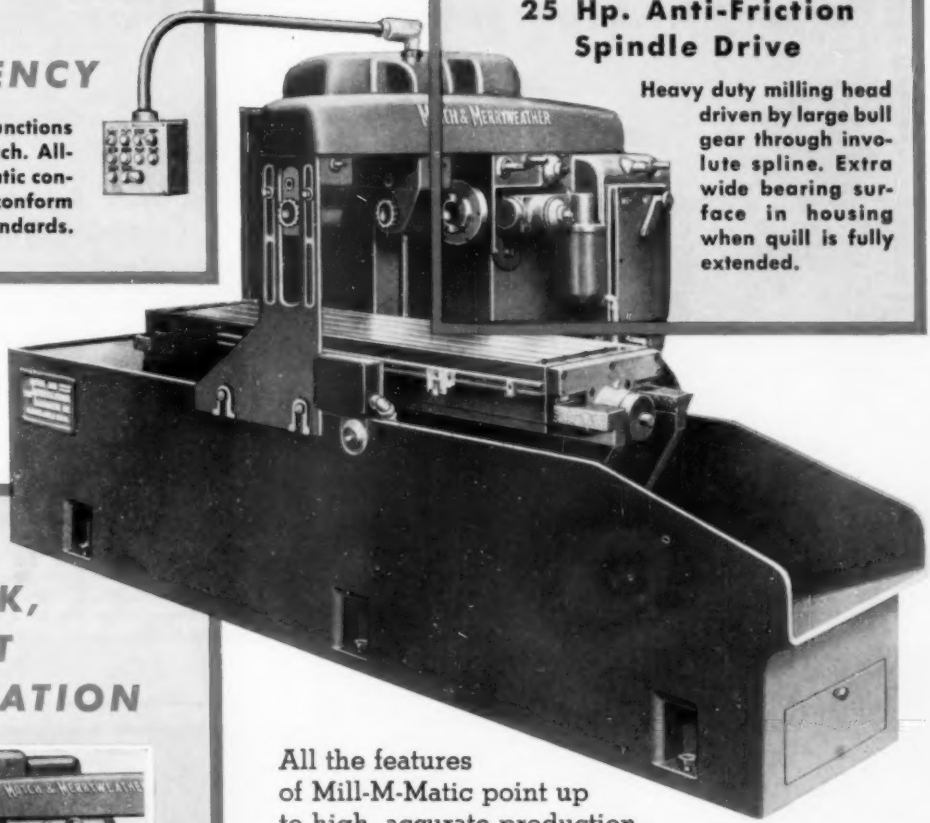
. . . for EFFICIENCY

All machine functions within easy reach. All-electric, automatic controls built to conform with J. I. C. standards.

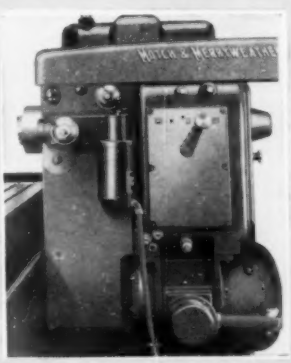
. . . for POWER

25 Hp. Anti-Friction Spindle Drive

Heavy duty milling head driven by large bull gear through involute spline. Extra wide bearing surface in housing when quill is fully extended.



. . . for QUICK, QUIET OPERATION



Hardened, ground gearing. Helical change gears for quick speed selections. Automatic spindle stop. 2-way automatic table cycles.

All the features of Mill-M-Matic point up to high, accurate production.

A fresh approach employing control by electric-mechanical powered action opens new possibilities in long life and precision operation in the field of *production milling*. Our 10-page bulletin describes all the advantages found in Mill-M-Matic.

The MOTCH & MERRYWEATHER Machinery Co.

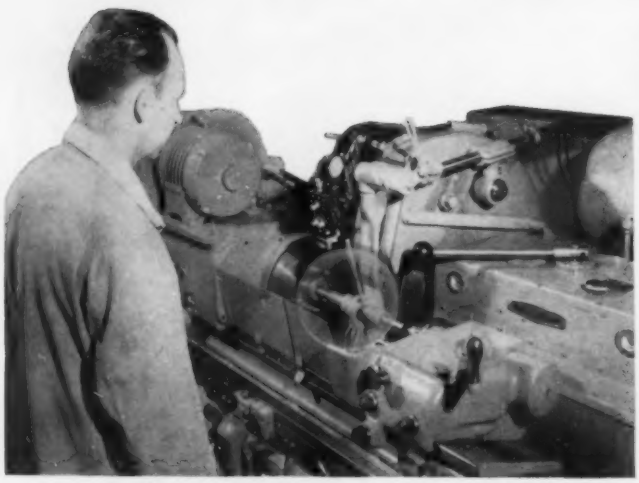
MACHINERY MANUFACTURING DIVISION

CLEVELAND 13, OHIO

More proof of how

Norton G Bond wheels boost O.D. grinding profits

Users praise "TOUCH of GOLD" *performance that steps up production rate and quality while cutting costs*



Cylindrical Grinding is faster, easier, more profitable when wheels made with the Norton G Bond — most efficient vitrified bond ever developed — add the "Touch of Gold."

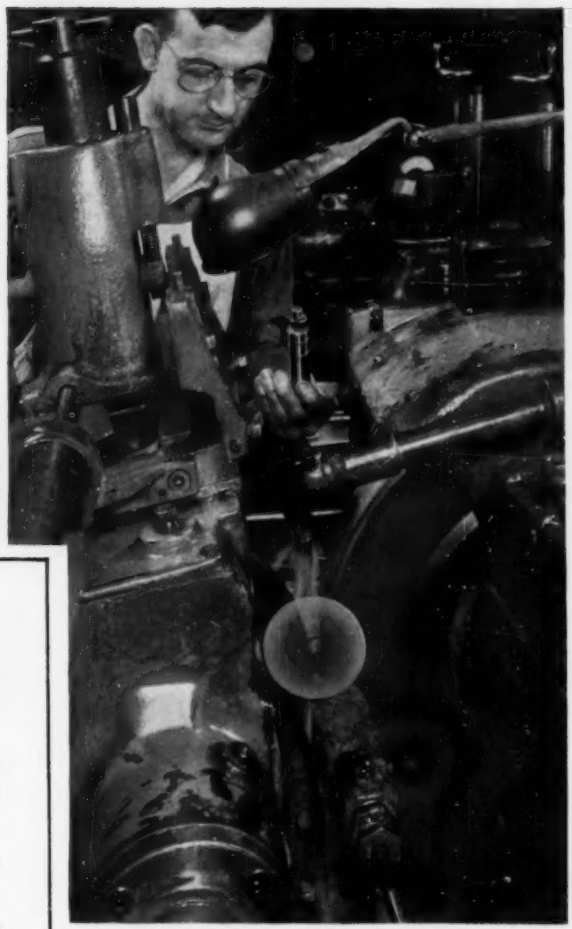
Users' Reports on Cylindrical Grinding

Job: Assorted small diameter stock.
Report: G Bond wheel gave 50% more pieces per dressing, with greatly improved finish.

Job: Rear axle pinions, SAE 4120 stock.
Report: Grinding to .001" limits, G Bond wheels removed stock faster, more uniformly. Gave more pieces per dress, with less spark-out time.

Job: 3" diameter formed roll, hard steel.
Report: Cooler cutting, crush-trues nicely, holds form. Best wheel ever used.

Job: Hardened steel raceways of ball bearing "inners."
Report: Ground 60 of the .075" radius grooves per dressing, compared to 25 with previous wheel. This G Bond wheel, also used on critical shoulder job, held form and gave superior finish.



Centerless Grinding benefits by the G Bond's unique ability to hold each abrasive grain just long enough for maximum cutting action — an important "Touch of Gold" advantage.

Users' Reports on Centerless Grinding

Job: ¾" diameter x 2" textile spindles, spindle steel.
Report: G Bond wheels produced better form and finish than any other wheels. Gave 50% more pieces per dressing on both rough and finish grinds. Also eliminated previous distortion of spindles due to overheating.

Job: Removing up to .010" per pass on varied steel parts.
Report: Dressing required only once every 4 hours, instead of every 40 minutes. Best general purpose wheel ever used on our centerless machines.

Job: Thru-feed ½" diameter bar stock, stainless steel.
Report: Cut faster and freer, held size better and gave better finish than previous standard wheel.

Job: ½" diameter shafting, drill rod and stainless steel.
Report: G Bond wheel gave 16 hours longer wheel life and produced much better finish.

In O.D. grinding, as in many other precision and semi-precision grinding operations, first-time users of G Bond wheels are quick to recognize that here, at last, are wheels that will outperform any others they ever used. Advantages like these are the reasons why:

Cooler cutting action . . . faster stock removal . . . better finish . . . more pieces per dressing . . . longer wheel life . . . easier dressing, with less wear on diamond or on crushing roll.

Added up, all these new advantages mean valuable production economies and improvements in your product. That's why G Bond users have been glad to show their appreciation — with a steady stream of endorsements like those reproduced here.

Your Norton Distributor

is ready with proof of how G Bond wheels can add the work-speeding, profit-increasing "Touch of Gold" to your own cylindrical or centerless grinding jobs. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your classified 'phone directory. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass. W-1575

Making better products . . . to make other products better

NORTON

NORTON: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING: Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

Yes YOU CAN sharpen carbides WITHOUT diamonds

BIG ATTENTION-GETTER at the MACHINE TOOL SHOW

These men in the huddle are watching Ex-Cell-O's new METHOD X MACHINE—many of whom actually sharpened tools on the machine—and all were impressed by the process that eliminates the diamond wheel in sharpening carbides.

- The "grinding wheel" is simply a cast-iron disc.
- It does both roughing and finishing.
- It cuts carbides and steel at the same time.
- *Cuts any material that's an electric conductor!*

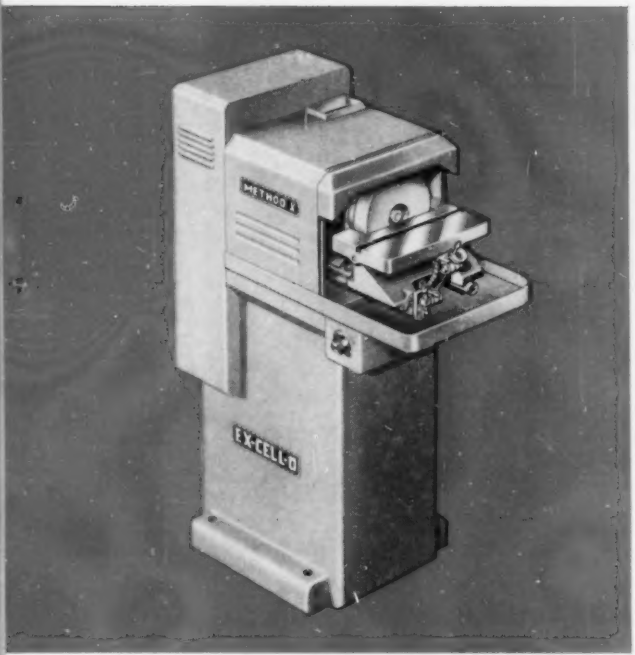
EX-CELL-O Method X TOOL SHARPENER

lengthens the life of your CARBIDE TOOLS because this process leaves

- NO heat checks—
- NO grinding cracks—
- NO saw-tooth cutting edges

EX-CELL-O Method X TOOL SHARPENER

You save the cost of your Method X Machine over and over, because you use no diamonds



EX-CELL-O METHOD X TOOL SHARPENER has an Ex-Cell-O Precision Spindle with inbuilt motor that rotates the 10-inch cast-iron disc. The tool-rest table is of ample size to support large tools firmly. The protractor plate indicates setting in degrees . . . No coolant is needed in the sharpening process.

Ex-Cell-O's Method X is an electromechanical process, sometimes called electro-spark erosion, for off-hand sharpening of single-point tools. A current source has its positive terminal connected to the tool to be sharpened (which is at ground potential) and the negative terminal is connected through the mounting flange to an iron disc. A semi-solid dielectric or insulating film is applied to the disc to provide a spark gap. As the tool is oscillated across the disc, current pulsations jump across the spark gap, dislodging particles from the workpiece.

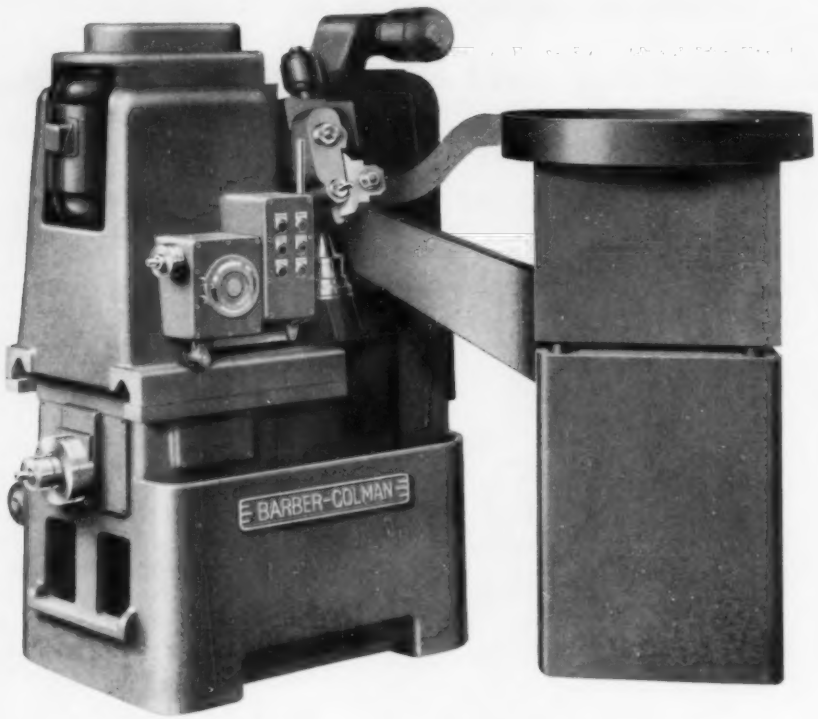
Method X produces a non-directional matte finish, the coarseness of the texture (and cutting speed) depending on the power selected. In the power unit, the electrical energy is stored for an instant, then quickly discharged. There are two cutting rates, selected by positioning a switch. The machine electric control is built to NMTBA and JIC standards.

Phone your local Ex-Cell-O representative — or phone, wire or write Ex-Cell-O in Detroit for all the facts about METHOD X.

Method X off-hand tool sharpening is much like conventional grinding. Cutting speeds for carbides are comparable with those for grinding with diamond wheels. Your operators with experience in conventional grinding can change to the Method X process with brief instruction.

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN
MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES
CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

a NEW automatic high-speed hobbing machine...



The Barber-Colman No. 3-6 Vertical Hobbing Machine is a single-purpose machine designed and built to meet the requirements of a specific job. The machine has standard basic elements, but the tooling, loading, gaging and handling are designed for maximum production of a specific part. Its high-speed operation makes it adaptable to all mass produced parts up to 3" diameter by 6" face width. Maximum pitch capacity is 10 DP. Hob speeds for carbide hobbing of non-ferrous and non-metallic blanks are available. Features which contribute to the high-speed operation of this machine include exceptionally large heat-treated and ground bed ways, short drives to the work and hob spindles, and a hardened and ground multiple-thread index worm.

B U I L D E R S O F P R E C I S I O N G E A R

BARBER • COLMAN

No. 3-6

for high production gear cutting with automatic handling, loading and gaging

automatic loading	Blanks are automatically loaded from a vibratory hopper loading device. However, the type and variety of loading and handling devices with which this machine can be equipped are almost unlimited. Loading can be by magazine or conveyor when required.
automatic gaging	The gaging mechanism segregates gears of the correct size from those that are oversize or undersize. Size inspection is made by measuring over balls. If a pre-determined percentage of gears are out of tolerance, the machine can be made to stop automatically. The gaging unit can be furnished to inspect almost any elements of the gear.
automatic hob shifter	The automatic hob shifter can be set to shift a certain amount after each cycle, or it can be arranged to shift after a certain number of parts have been cut. Shifting increments can be changed easily by means of a graduated dial. The hob slide is clamped pneumatically.
centerdistance adjustment	The hob is set to the proper depth by means of a centerdistance adjusting mechanism, eliminating the usual time-consuming method of setting the hob to depth. The hob is placed in a fixture, and an indicator finger is set against the outside diameter. The indicator is calibrated to show the centerdistance between the work and the hob. This centerdistance setting is made by means of a graduated dial on the machine.

Some basic machine facts:

- Short, Compact Drives to Work and Hob Spindles
- Anti-Friction Work and Hob Spindle Bearings—Tapered Roller Type
- Pneumatic Work Clamping
- Self-Contained Lubrication and Coolant Supply
- Heat-Treated and Ground Bed V-Ways
- 2 HP, 1800 RPM Drive Motor
- Unitized Construction

HOBS • CUTTERS • REAMERS
HOBBING MACHINES
HOB SHARPENING MACHINES

BARBER COLMAN

Barber-Colman Company

GENERAL OFFICES AND PLANT, 631 ROCK STREET, ROCKFORD, ILL.

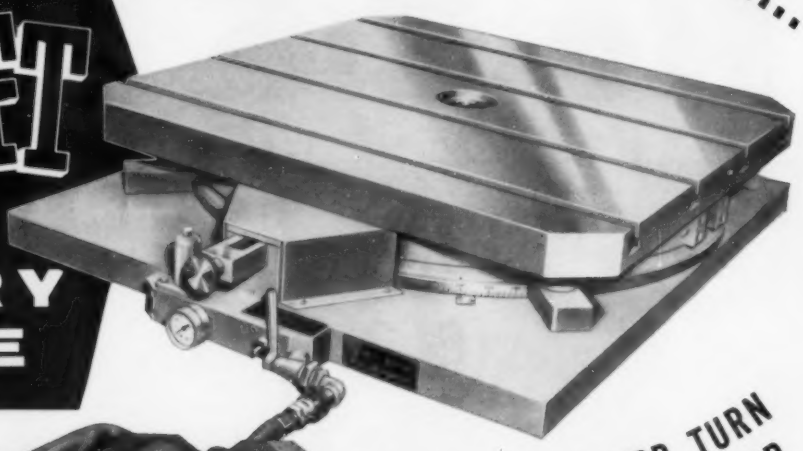
HOBS AND MACHINES SINCE 1911

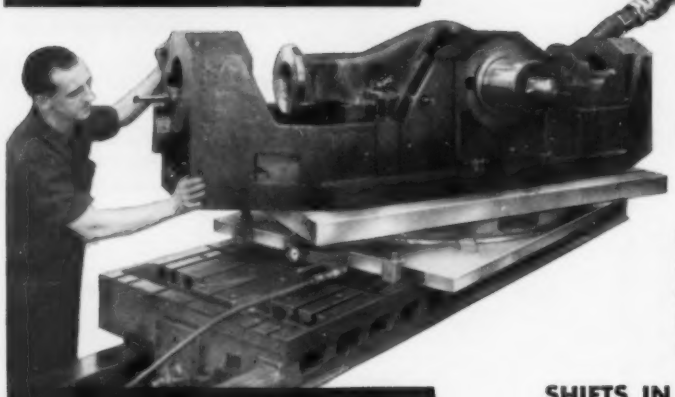
new

GIDDINGS & LEWIS

AIR-LIFT ROTARY TABLE

floats platen on cushion of air...





TO HELP OPERATOR TURN HEAVY WORKPIECES EASIER

Here's the most valuable time-and-labor saver ever developed for heavy machining. In this revolutionary new Rotary Table design, G & L engineers have put air to work to make operators' jobs easier—and their output more accurate.

SHIFTS IN CLAMPING ELIMINATED

Compressed air raises the table platen so operator actually revolves his workpiece on a drag-free cushion of air. Even heavy, overhanging work turns as though it were weightless. With no oil present to permit shifting, the platen clamps in a solid, metal-to-metal contact with table to assure more precise work settings.

MAXIMUM RIGIDITY FOR CLOSE WORK

This exclusive G & L design provides far more contact area between platen and seat than is possible in any other type—making work rock-steady under heaviest cuts and thrusts. An expanding wedge-type index pin eliminates play and lost motion while compensating for wear. For positive indexing, this pin locks firmly in table and index block at each 90° of rotation. Intermediate settings to ½° are facilitated by a graduated ring. Learn how this new table can reduce your machining time by contacting your nearest representative or writing to—

11 MODELS MEET EVERY NEED

ROUND-PLATEN TABLES

Available in 36", 48", 60" diameters.

SQUARE-PLATEN TABLES

Available in 36", 48", 60" sizes.

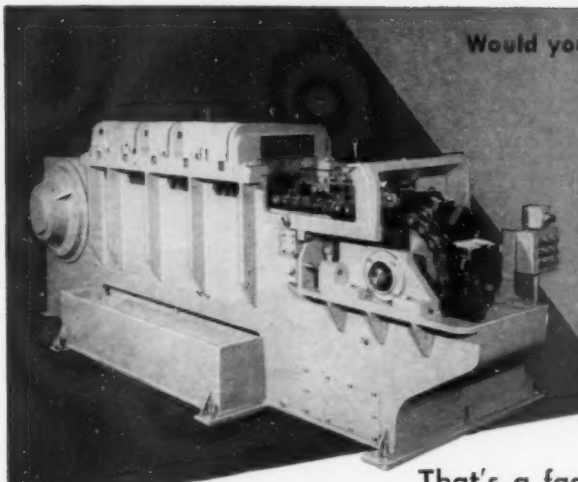
RECTANGULAR-PLATEN TABLES

Available in 36x48", 48x66", 60x72", 60x84" and 60x96" sizes.

GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines—table, floor and planer types; Hypro Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Vertical Turret Lathes and Davis Cutting Tools.



Would you believe that this machine

BROACHES

3 EXTERNAL SLOTS SIMULTANEOUSLY,

producing 1800 complete parts per hour?

That's a fact!

And it not only broaches slots, but this 10 hp. 42-inch stroke

LAPOINTE

CONTINUOUS BROACHING MACHINE

can be tooled up for broaching many types of small parts requiring close tolerances — and at production speeds unheard of only two years ago!

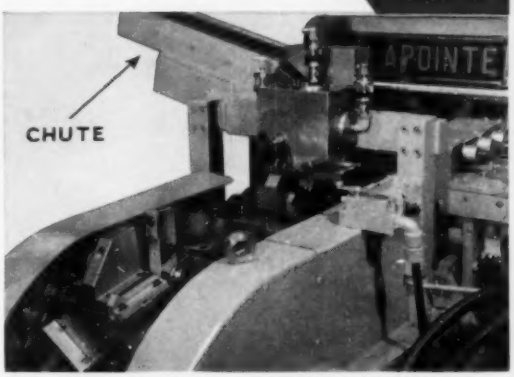
Better look into LAPOINTE Continuous Broaching, on the ***machine that doesn't stop***. Write today for **BULLETIN CH-1.**

LAPOINTE **CONTINUOUS BROACHING MACHINE**
Available in 4 standard sizes
10 hp. 42-inch stroke
20 hp. 66-inch stroke
30 hp. 90-inch stroke
40 hp. 120-inch stroke

Any desired combination of horsepower, stroke, and speed can be obtained.

LAPOINTE BUILDS THE MACHINE, BUILDS THE FIXTURES, AND MAKES THE TOOLS.

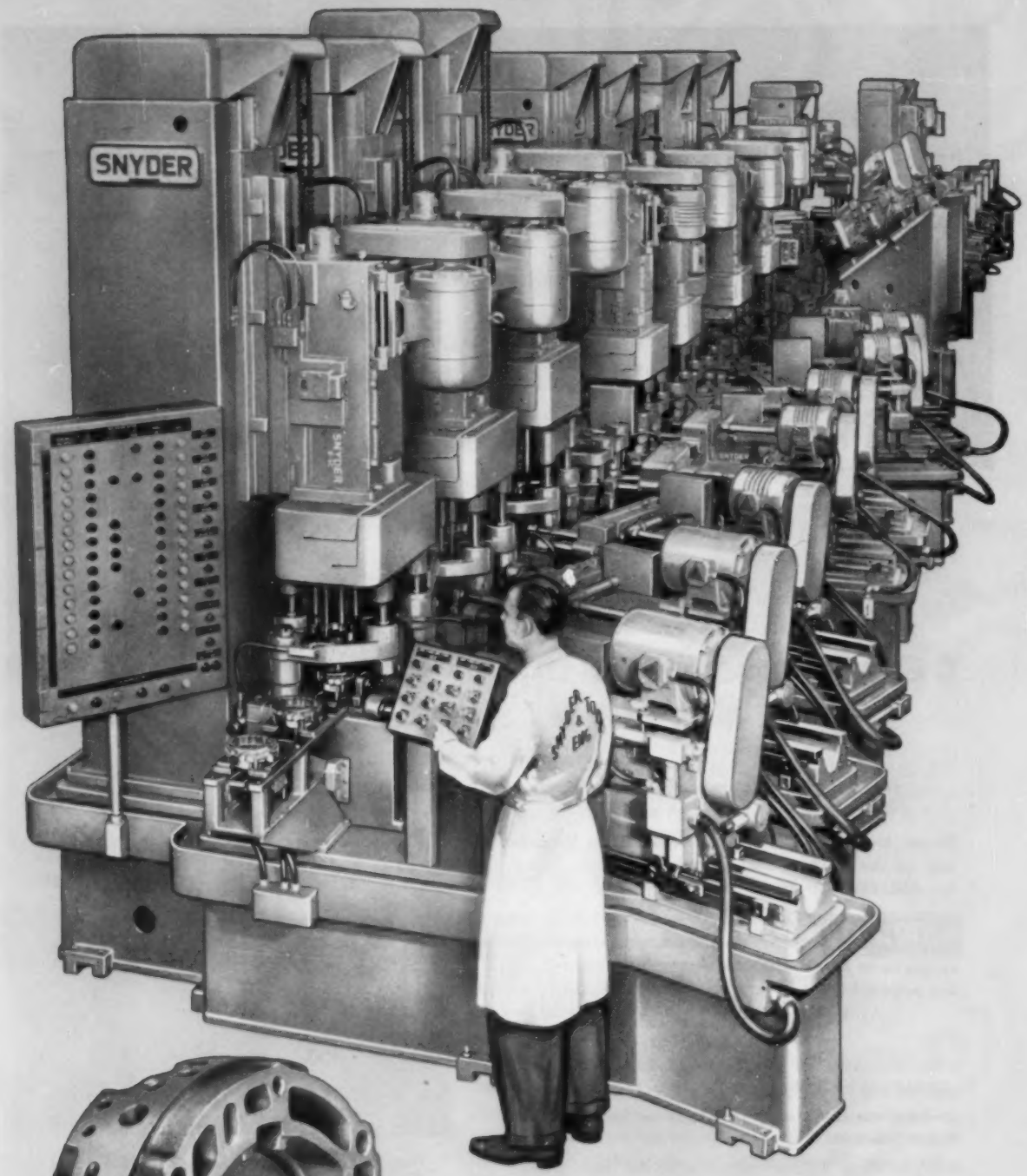
Lapointe takes *all* the responsibility for your CONTINUOUS BROACHING program!



Parts are automatically fed into the individual fixtures from a chute, filled manually by operator.

THE LAPOINTE MACHINE TOOL COMPANY
HUDSON, MASSACHUSETTS, U. S. A.

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES



An individual station is provided for ejecting parts when the first section of the machine is operating and the second section is down for tool changes. Also shown is the turnover mechanism which turns the part through 180 degrees for operations on the other side. ⟶

SNYDER SEGMENTED AUTOMATION in 23 segment, 75 station, in-line, transfer machine permits part design flexibility, conversion to processing similar parts, limited obsolescence; drills, reams, spotfaces, chamfers, bores, counterbores, mills, taps, and automatically air gages work on automatic transmission front oil pump bodies at 144 pieces an hour at 80% efficiency.

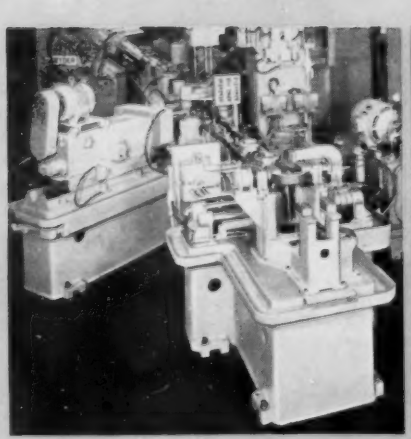
SNYDER

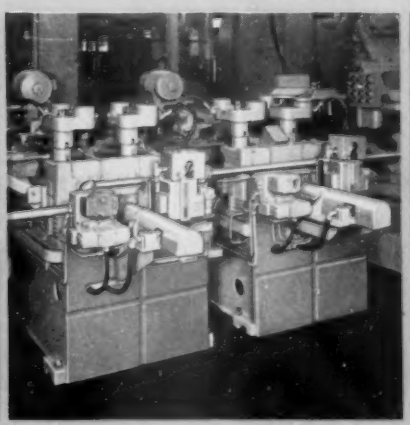
TOOL & ENGINEERING COMPANY

3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

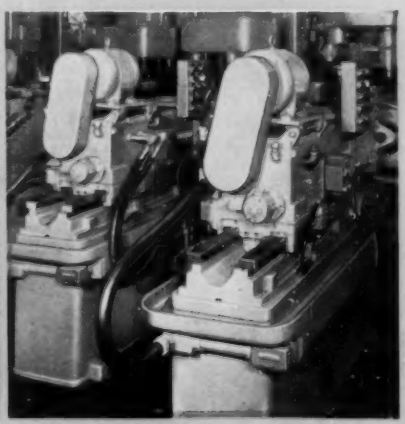
31 Years of Special Machine Tools with Automation

Segment bases are designed for mounting units for future operations, a feature of the flexibility and convertibility of the machine.



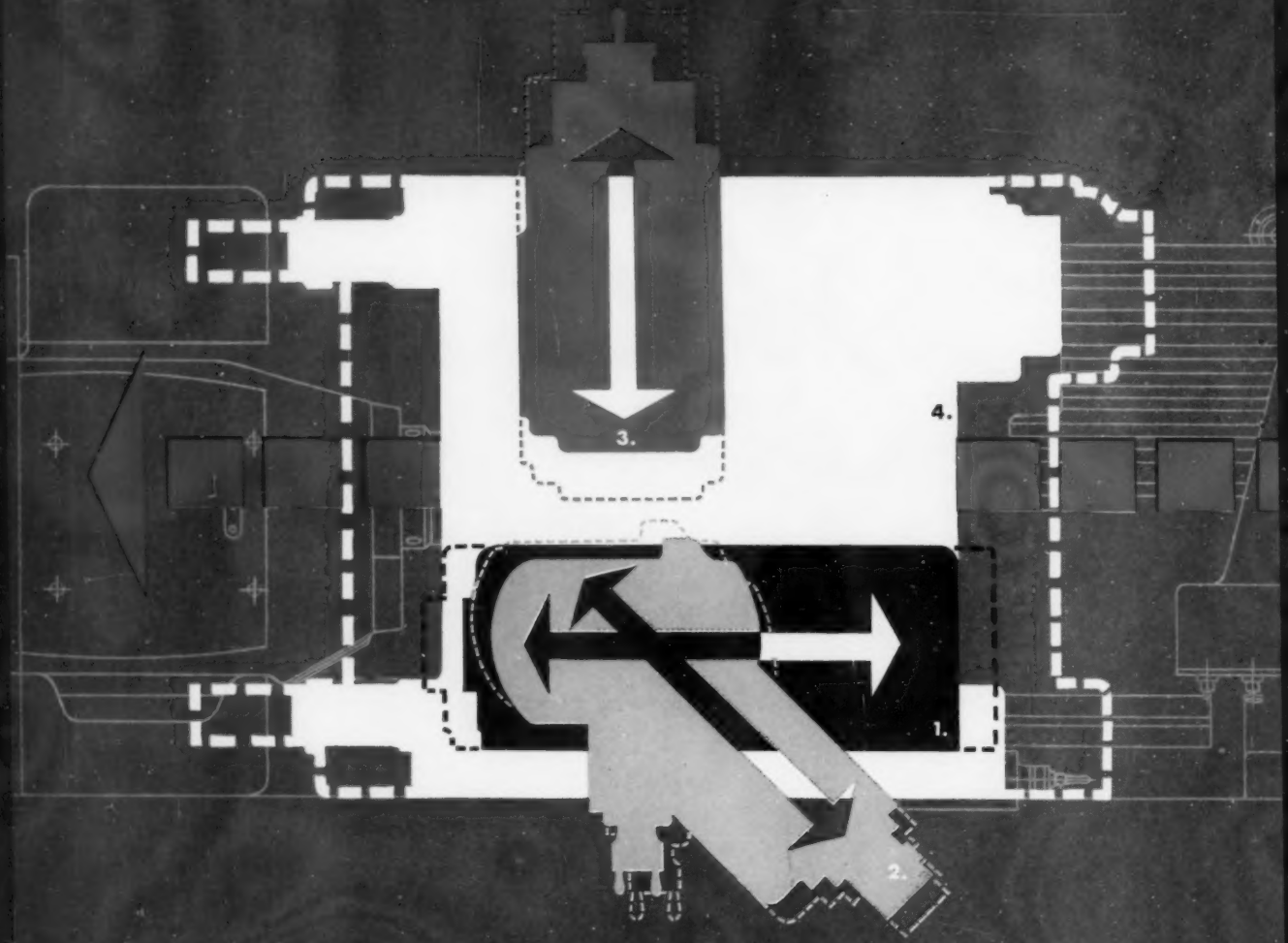


Each segment has individual push button station. Note the accessibility of tools.



ACTION That's the Word for Hydra-Slide!

ARROWS SHOW SLIDE MOVEMENTS OF MONARCH'S NEW AUTOMATIC CYCLE CHUCKING LATHE



1, 2. Basic unit, most models—hydraulically operated front slide unit, on which is mounted famous Monarch Air-Gage Tracer. Utilized generally for straight or contour turning, facing, or boring.

3. Hydraulically operated rear slide unit for necking and grooving—is ideal with proper tool setting for facing, for which hydraulic automatic tool relief is provided.

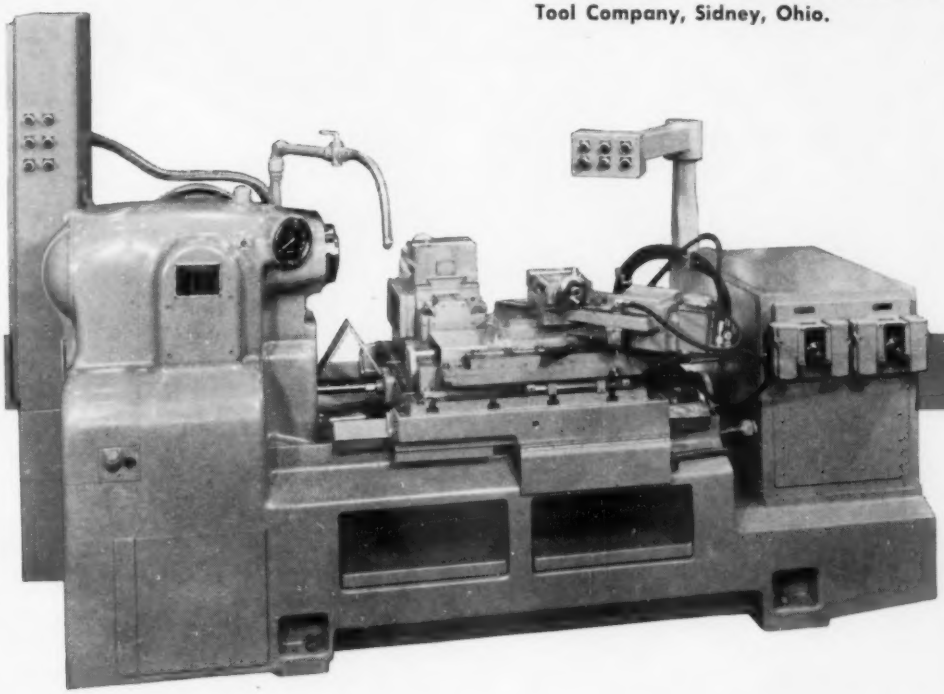
4. Platen with hydraulic movement, on which both front and rear slide units are mounted. Speeds cycle for work piece change!

HERE'S ACTION in the fight against rising production costs—with a fully automatic cycle controlling an extremely effective combination of hydraulic slide movements. Look them over! Here's an exceptionally versatile, high production chucking lathe for both first and second operation work.

Although the typical cycle presumes a tool or tools on both front and rear slides, and is based on the ideal production-wise situation of simultaneous operation of slides—the versatility of the machine is such that many variations can be set up. Of course, there are convenient all-electrical controls for effortless and positive setup.

The Hydra-Slide has ample capacity as to work size and stock removal both, with work diameter capacity up to 15" over front slide unit —up to 13" over rear slide unit—and work drive motor ratings up to 20 H.P.

Here's action—production-wise and cost-wise! You should know *all* about a machine like this. Send the coupon today for our complete illustrated booklet #1703—**The Monarch Machine Tool Company, Sidney, Ohio.**



The Monarch Hydra-Slide. Front Slide, with Air-Gage Tracer, provides smooth, stepless cut for multiple diameters, tapers, faces, radii and chamfers with single-tool economy. One or more tools on rear unit neck, groove, form cut, and face. Both mounted on platen. Send coupon for complete story.

Monarch
TURNING MACHINES
FOR A GOOD TURN FASTER . . . TURN TO MONARCH

THE MONARCH MACHINE TOOL COMPANY
SIDNEY, OHIO

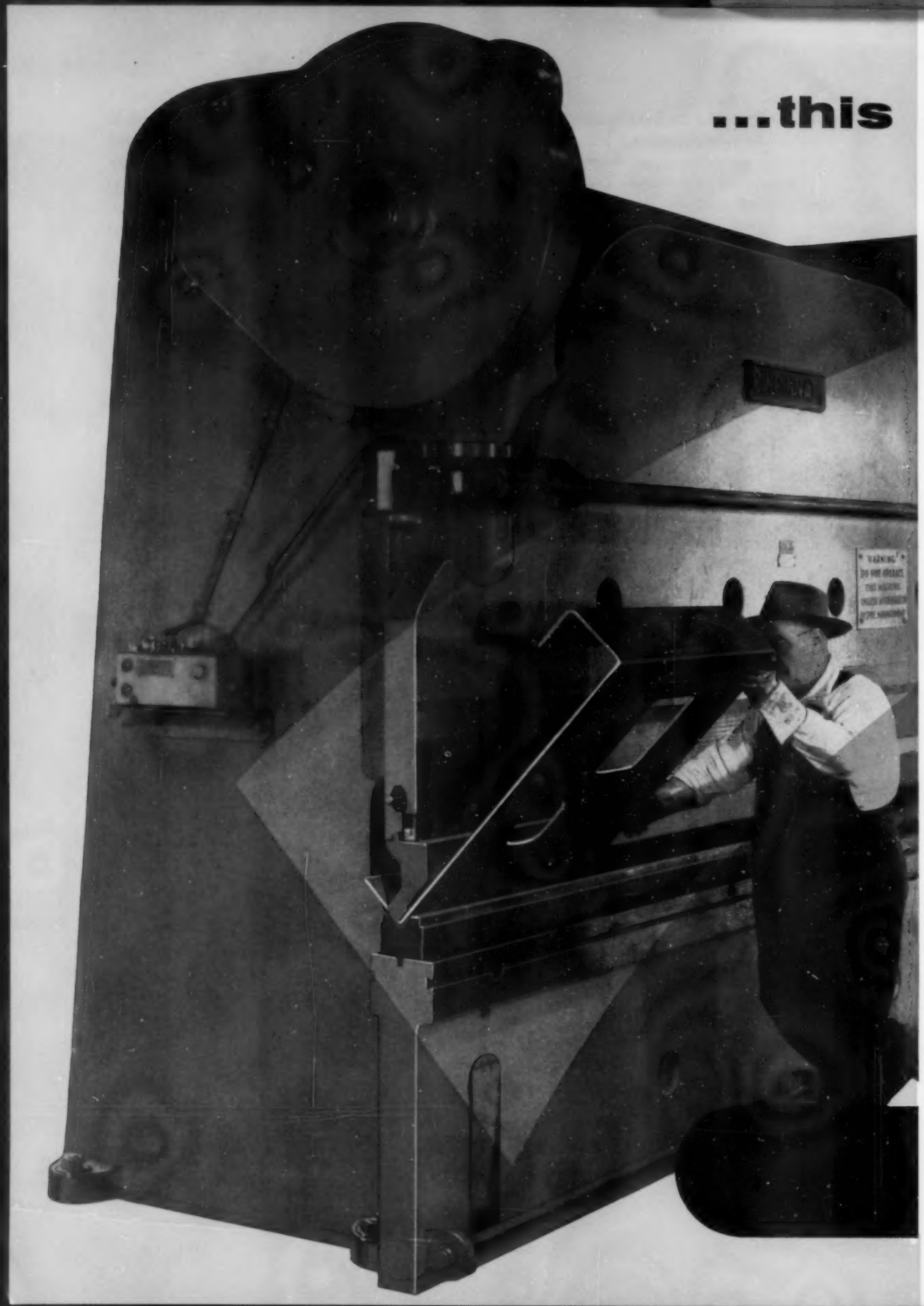
Please send me your illustrated booklet #1703 on the new Monarch Hydra-Slide.

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____


...this

modern CINCINNATI PRESS BRAKE...

gets the orders

at MARION MACHINE, FOUNDRY & SUPPLY CO.
Marion, Indiana

This Cincinnati Press Brake immediately produced orders in a highly competitive jobbing market.

A $25,000 job, which previously would have been lost, was profitably handled. A 3" channel with 2¾" flanges was formed in six gauge material.

Investigate these modern design features for low cost production.

- Centerline loading.
- Rigid, All-Steel Construction
- Deep beds and rams
- Interlocked construction
- Large, high strength radii—free of weld
- Ram elevation—complete with micrometer indicators
- Tilting ram adjustment

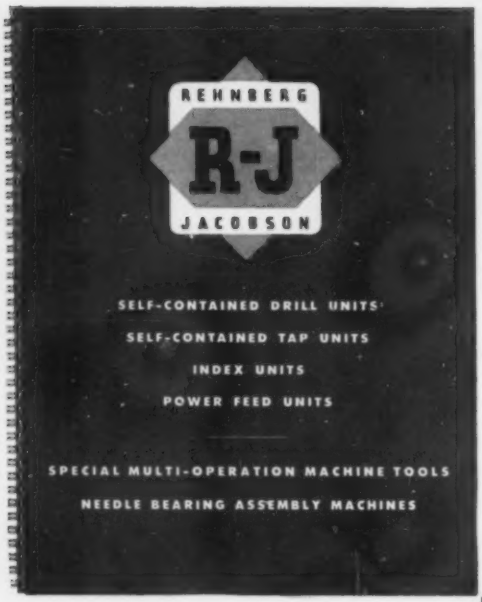
Write for Cincinnati Press Brake Catalog B-4.

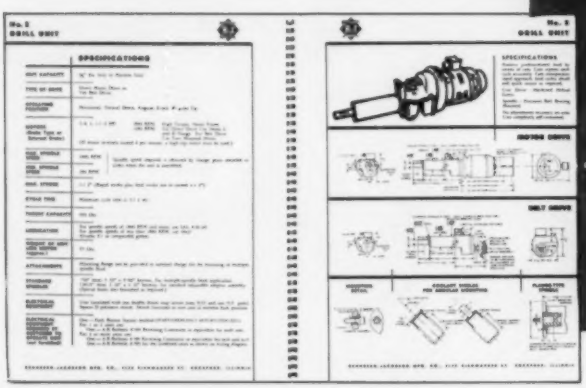
Photos courtesy the Marion Machine, Foundry & Supply Company, Marion, Indiana.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI





SEND FOR THIS FREE MANUAL

It contains detailed specification sheets and complete dimension drawings on all the standardized R-J Drill Units, Tap Units, and Index Units. Also, you will find wiring diagrams for the individual units and for any combination of them. With this information you can determine just what operations you can perform with the R-J units, and exactly how they will fit on any machine structure you have in mind. Finally, the Manual contains numerous illustrations and descriptions of various types of Special Machine Tools designed and manufactured by Rehnberg-Jacobson, and some examples of an R-J specialty—Needle Bearing Assembly Machines. *Write for a copy of this R-J Specification Manual today.* If you need extra copies, we will be glad to furnish them as long as the supply lasts.

Designers and Builders of Special Machinery

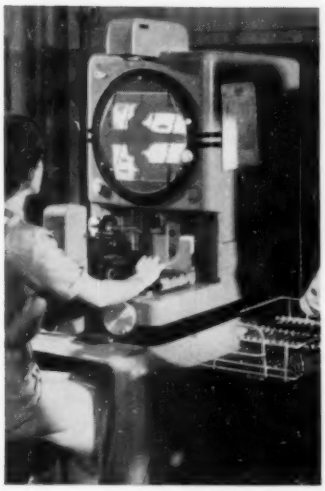
REHNBERG-JACOBSON MANUFACTURING COMPANY

REHNBERG R-J JACOBSON

2135 KISHWAUKEE ST.

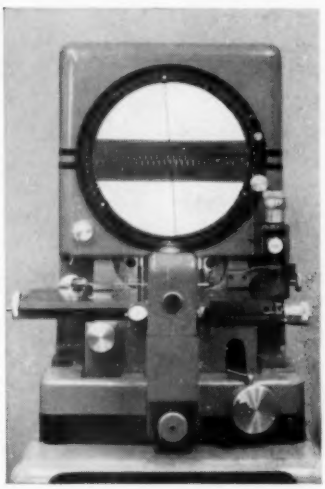
ROCKFORD, ILLINOIS

How many places in your plant can projection gaging save time and money?

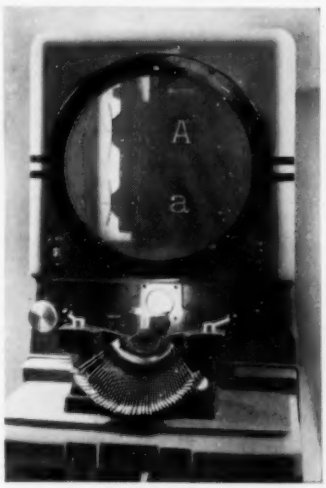


In the toolroom? Look at this. Prior to adopting projection gaging, a Midwestern manufacturing plant required 725 man-hours monthly to inspect flat drills, taps, special cutters, and circular form tools. Use of a Kodak Contour Projector reduced inspection time 84% to 115 man-hours; cost of the projector was returned in direct labor savings within three months. If you have a heavy inspection load in your toolroom, chances are that optical gaging with Kodak Contour Projectors could effect similar savings for you.

In receiving? Here's the experience of a leading maker of aircraft engines. Their gaging procedure on jet engine blades called for inspecting 11 dimensions (including radii and angles) on the dovetail contour, 14 additional dimensions on the blade root. Using two Kodak Contour Projectors, they checked these pieces at a rate of 150 per hour. And operators required little training. What about your receiving inspection department? Couldn't a fast, highly accurate method of inspecting all sorts of parts with multiple dimensions and complex shapes help prevent bottlenecks?



In production? A lot of people don't think of optical gaging in terms of production inspection. A typewriter maker did. To check the alignment of type bars to ±.0002″, they placed a Kodak Contour Projector next to the soldering jigs on which bars are mounted on their arms. Catching errors at this point and correcting the jigs reduced alignment time in final assembly 25%. Install Kodak Contour Projectors next to production equipment and you have a fast, continuing check that insures machine settings are correct. That's a good way to keep scrap costs down and quality up.



In final inspection? Ever have a part that was almost impossible to inspect accurately and completely? A leading West Coast electronics manufacturer did. They had to check the precise pitch of a fine wire helix mounted in its glass tube. "Without the Kodak Contour Projector," the company reported, "it would not be practical to make the measurements necessary to get a satisfactory instrument." Many times optical gaging on a Kodak Contour Projector lets you measure small or easily distorted parts with a simplicity and accuracy you can't achieve by other methods.

WHATEVER your inspection or measuring problem, there's a Kodak Contour Projector to do the work, from the bench-type Model 8 to the big Model 30 with its 30-inch screen and large part capacity.

To find out more about how optical gaging can save you time and money, improve accuracy, send for the booklet, "Projection Gaging with Kodak Contour Projectors." Write *Special Products Sales Division.*

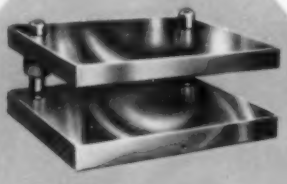
EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

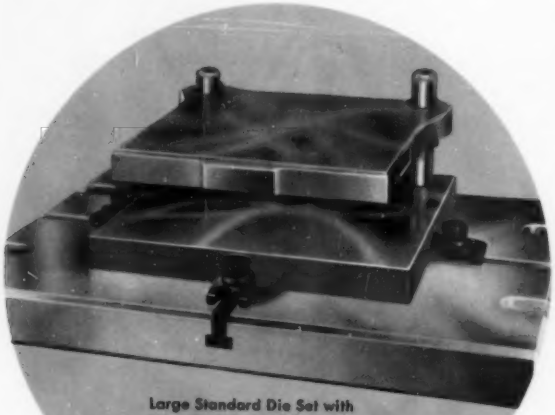
Kodak
TRADE-MARK

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-33

...see it all at the ASTE Show next month in Chicago!



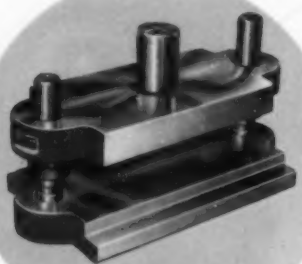
Large Precision All-Steel Die Set with clamping holes shown



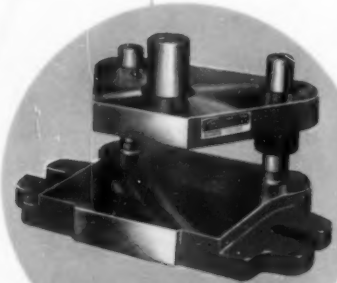
Large Standard Die Set with Semi-Steel Punch Holder and All-Steel Die Holder. New clamping method shown.

ALL-NEW DANLY

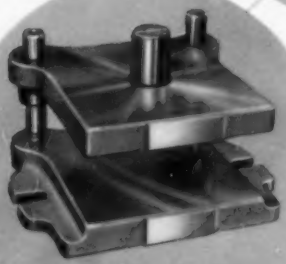
new dimensional standards... new longer life... new features



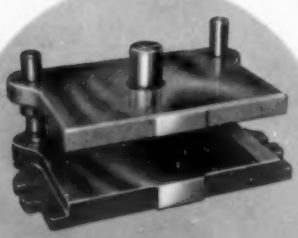
Center Post Precision All-Steel Die Set



V-Punch Holder Precision All-Steel Die Set

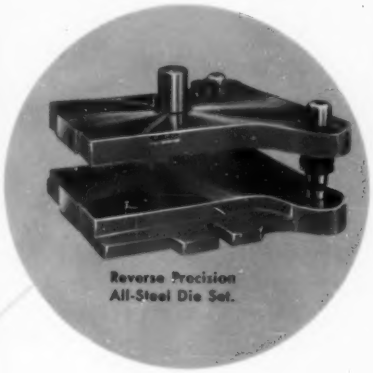


Back Post Precision Semi-Steel Die Set



Long Precision Standard Combination Die Set

8 Reasons Why Danly Leads The Die-Set Field!


Reverse Precision All-Steel Die Set.

1 Precision chrome plated MICROME guide posts wear longer and are now standard on all Danly Precision Die Sets.

2 Demountable bushings for exceptional degree of accuracy and ease of replacement are available.

3 New oil lubrication system for guide posts and bushings further protects bushings and posts from wear.

4 A complete new line of long and short shoulder Precision bushings of hardened steel . . . long shoulder types also available in hard bronze.

5 Easier faster clamping with Danly All-Steel Die Sets—clamping holes used where left to right dimension is 20" or more.

6 Removal of punch holder made easier. This feature assures easy assembly and disassembly during die making, die setting or regrinding.

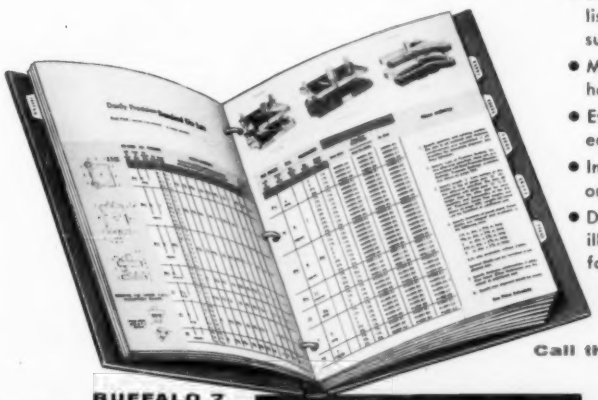
7 Danly meets or exceeds ASA Standards . . . offers many sizes not listed by ASA for a more complete selection.

8 All horizontal surfaces are ground to assure a flat, true working surface.

"LEADERSHIP LINE"

... introduced in this all new Danly catalog

more than 200 pages of technical information



- The most complete description and listing of die sets and diemakers' supplies available.
- Many new items helpful to diemakers have been added.
- Every page designed and tested for easiest possible selection.
- Included price book simplifies ordering.
- Detailed drawings and photographic illustrations provide handy reference for designers and buyers.

Call the Danly Branch Nearest You . . .

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Multi-Flex quiz for design engineers who want greater freedom of design

WHAT ARE U. S. MULTI-FLEX PRODUCTS?

They are accordion-like, tubular rubber products that have a versatility and an adaptability impossible to duplicate in connections made by conventional methods. Produced by United States Rubber Company, they are made of natural or synthetic rubbers—with or without cotton, asbestos, glass or nylon fabrics. With few exceptions, all U. S. Multi-Flex products are made to order for specific applications.

MULTI-FLEX PRODUCTS ARE CIRCUMFERENTIALLY CORRUGATED!

This gives flexibility, rigidity, and the ability to take movements in axial extension and compression. Other qualities are:
• Resistance to crushing and fatigue • Resistance to extremes of temperatures, abrasives, corrosives, oil, water, and grease • High travel ratio.

WHAT ARE SOME EXAMPLES OF MULTI-FLEX PRODUCTS?

Above are shown only six of the various styles of U.S. Multi-Flex boots. Because Multi-Flex boots are custom-made, THEY CAN BE "TAILORED" TO MEET THE EXTENSION, COMPRESSION AND DESIGN REQUIREMENTS OF ALMOST ANY APPLICATION.

WIDE APPLICATION FOR MULTI-FLEX!

In industry: Multi-Flex boots are used for rams in hydraulic presses making grinding wheels or other abrasive materials; on adjusting screws in grinders and machine tools; for guide rods in mechanical stamping presses; for reciprocating parts and for pistons and worm gears in a multitude of applications; for any hydraulic cylinders and other reciprocating parts requiring protection.

Any maker of equipment with moving parts which need protection should investigate U. S. Multi-Flex®. For engineering advice, get in touch with any of our 27 District Sales Offices, or write us at Rockefeller Center, New York 20, N. Y.

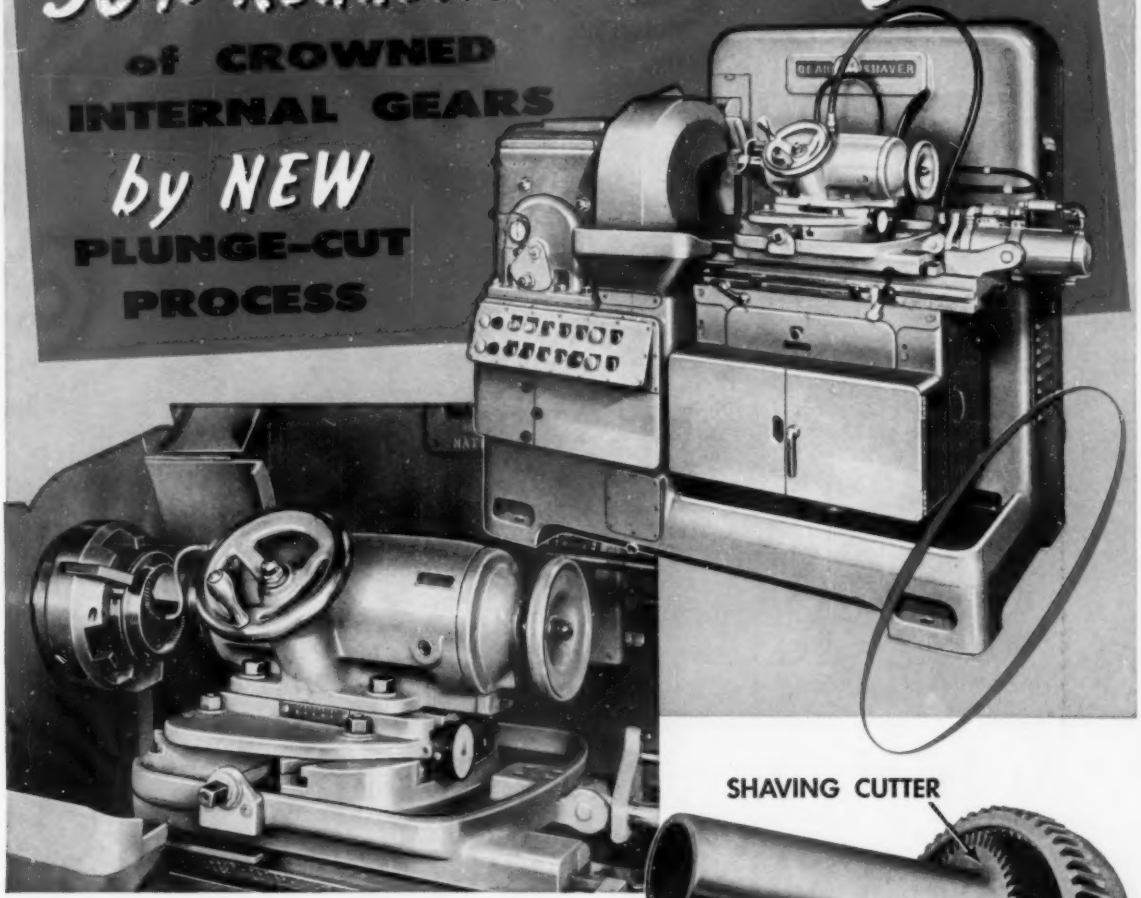
US RUBBER

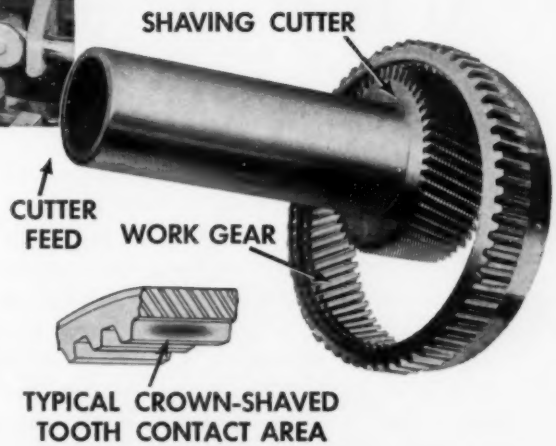
Mechanical Goods Division

United States Rubber

50% Reduction in Shaving Time

of CROWNED INTERNAL GEARS by NEW PLUNGE-CUT PROCESS





This typical internal automatic transmission gear is crown-shaved in 24 seconds machine time with the tooling shown.

Amount and position of crown for any specific work unit is optional.

The Plunge-Cut Process is equally applicable to straight-tooth gears and with the same economy in shaving time.

If you are mass-producing internal gears, write for Bulletin S55-6 on Internal Gear Shaving Machine, Model GCR

NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

At Ford Instrument Co., the answer is *Leland-Gifford* Drilling Machines

Problems involving precision mechanisms are duck soup for Ford Instrument Company, Division of Sperry Rand Corporation. They have the talent and the equipment to produce the right answers in the simplest and most practicable form.

Among their equipment is this battery of Leland-Gifford multiple spindle drilling machines. Here precision drilling operations are handled with efficiency and dispatch.

The right tools are ready for use in the right sequence and combination for drilling, reaming, tapping, countersinking, counterboring or spot facing. Work moves smoothly from one spindle to the next, requires a minimum of handling even for the most complex pattern of holes.

Leland-Gifford multiple spindle drilling machines are available in a complete family of sizes and in a wide range of swings, number of spindles and types of feed. New bulletins give complete information. Write for them.

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100% performance

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- live long
- finish smooth

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DERBY LINE, VERMONT, U.S.A.

NIAGARA FRONT-TO-BACK

ALL NEW rugged, front-to-back crankshaft with huge crankpins

ALL NEW compact, fully concealed driving mechanism

ALL NEW enclosed, rigidly supported gearing in sealed oil bath

ALL NEW electro-pneumatic friction clutch on crankshaft

ALL NEW wider spaced, longer, narrower gibs

ALL NEW wider, box type slide all within gibbing

ALL NEW precision, hardened, longer-wearing gears

ALL NEW compact, straight-line, space-saving frame

Hailed as the greatest achievement in modern OBI press design and performance, by over 100,000 spectators who examined this mechanical marvel at the Machine Tool Show, the all-new Niagara Series E, Single Point, Open Back Inclinable Press starts a brand new chapter in press history.

It's years ahead of any OBI ever built. It's an industrial revolution all by itself. No other press, in modern times, embraces so many "All-New" features.

Gone are exposed, overhanging gears, flywheel and other mechanisms. Gone is excessive and damaging crankshaft deflection. Here to stay are: Full support to wide dies. Greater resistance to off-center loading. Accurate alignment of slide, with minimized tendency to cock. Substantially increased die life. Longer lasting, hardened gears. Smoother, safer press performance. Smaller floorspace requirements.

Built in 4 sizes, with shaft diameters from 4½ to 7½ inches and capacities from 75 to 200 tons, the new Series E is available in both standard models and automation models equipped with the most advanced controls and devices for peak production. A complete description of both, with full specifications, is given in new Bulletin 56, sent promptly on request.

SEND FOR NEW BULLETIN . . .

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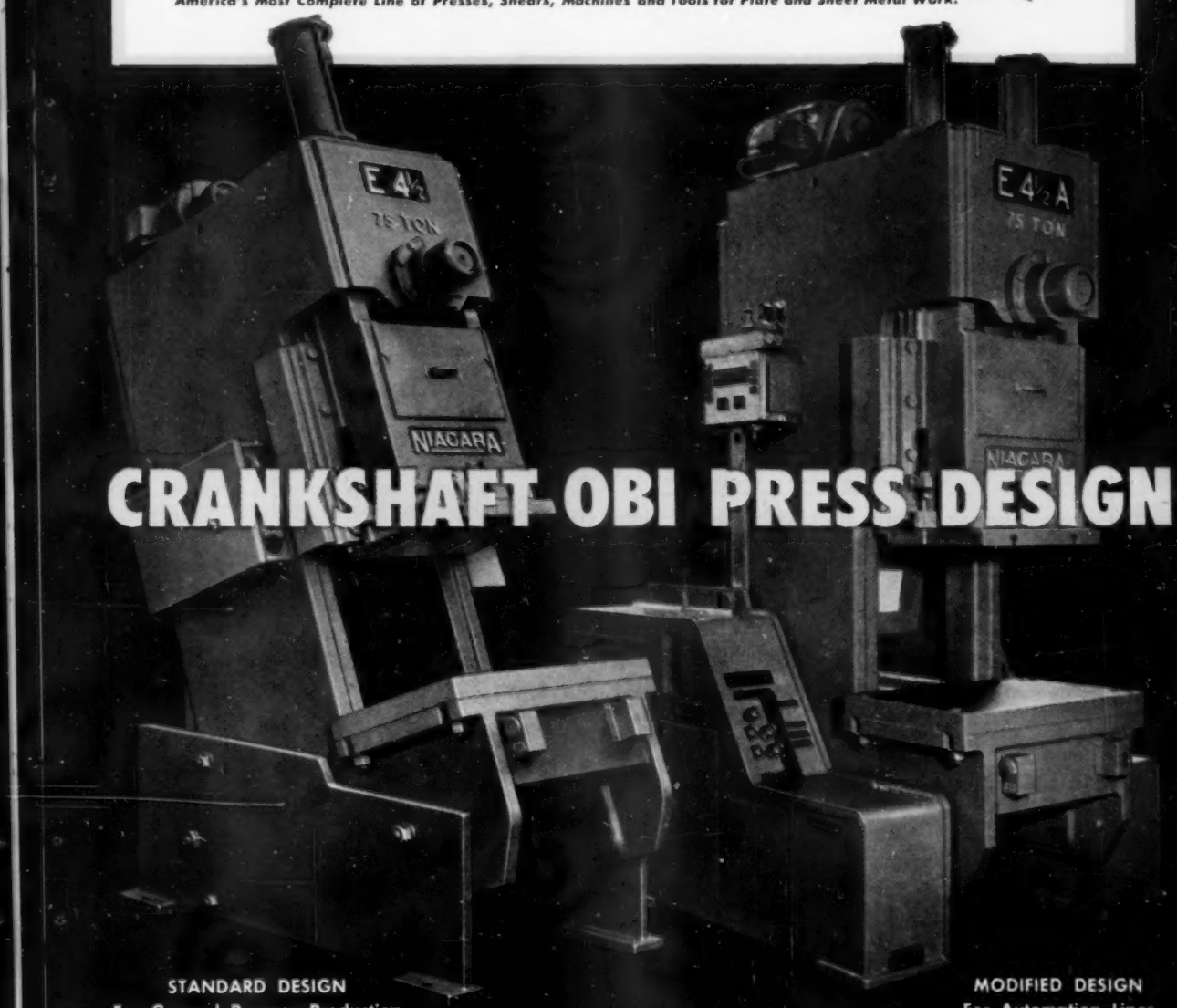
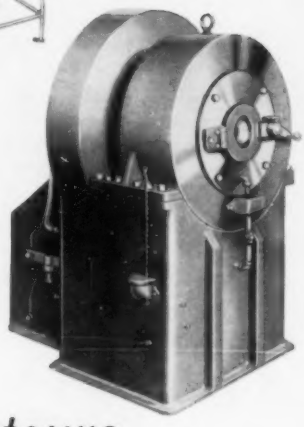
CRANKSHAFT-OBI PRESS DESIGN

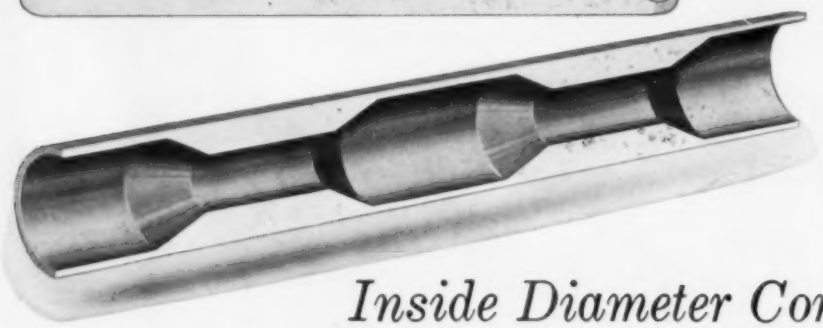


STANDARD DESIGN
For General Purpose Production

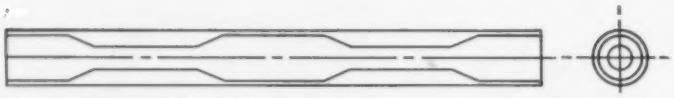
MODIFIED DESIGN
For Automation Lines

Swaging Success Stories



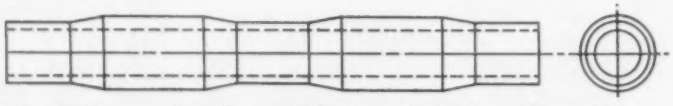


Inside Diameter Contours Easily Produced by Swaging



Machining multiple-diameter contours on the inside of cylindrical pieces (Fig. 1) is a difficult, time-consuming job.

Torrington's Swager experts start with tube of larger OD (Fig. 2) and machine the blanks to predetermined outside shape (Fig. 3).



Simply by swaging the outside to a straight, uniform diameter, the intricate contours are transferred to the inside (Fig. 4). Result: a sizeable saving in machining costs.

Swaging Advantages...

No Chips...No Waste...No Scrap

Swaging reduces metal—saves material—does not cut it away wastefully.

Swaging work hardens metal—gives it added strength, better finish and resiliency, dimensional accuracy.

Swaging is fast—can be done by unskilled workers to produce more pieces at lower cost.

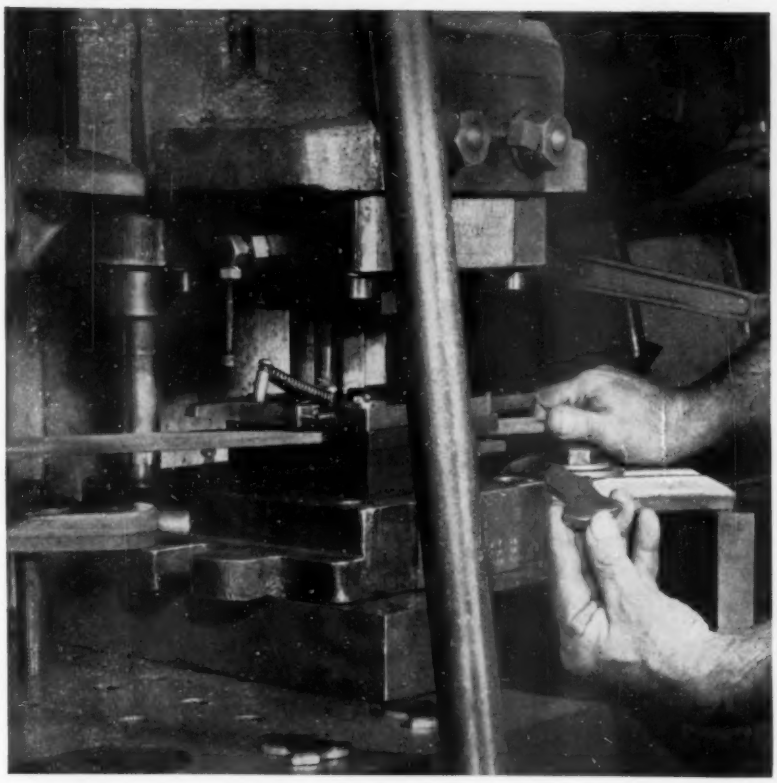
Write for our informative booklet on Swaging that gives detailed descriptions of Torrington Rotary Swagers. It may show you how to achieve new savings in your own plant.

THE TORRINGTON COMPANY
Swager Department
444 North Street, Torrington, Conn.
Makers of Torrington Needle Bearings

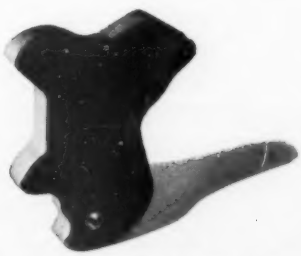
TORRINGTON ROTARY SWAGING MACHINES

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.



Blanking Die of Lehigh H Produces 15,000 Shotgun Hammers Between Grinds



A minimum of 15,000 shotgun hammers between grinds, with occasional runs as high as 20,000—that's the kind of performance they're getting with Bethlehem Lehigh H in a blanking operation at Milford Tool & Die Co., Milford, Mass. And the operation isn't easy, for it involves an intricate section, heavy weight of stock, and heavy scale condition.

The die is hardened to Rockwell C 59-60, and operates in a 70-ton press. It blanks 8620 hot-rolled alloy steel, ¼ in. thick, the finished part looking much like a piece to a jigsaw puzzle. From 0.004 to 0.006 in. is removed in redressing.

Lehigh H is our special-purpose high-carbon, high-chromium tool steel. It is easy to machine, and undergoes minimum distortion in heat-treatment, resulting in high compressive strength. Lehigh H is a deep-hardening steel. It has good wear-resistance, and is safe for intricate dies having sharp corners.

If you would like to try Lehigh H in your shop, you'll find your tool steel distributor anxious to be of service. Call him at any time. Lehigh H may also be obtained direct from our mill depot.

NEW COLOR FILM ON TOOL STEEL

You'll like our new educational motion picture, "Teamwork." The film takes you behind the scenes in describing the manufacture, quality-control, heat-treatment, and end-uses of Bethlehem carbon, oil- and air-hardening, shock-resisting, hot-work, and high-speed tool steels.

"Teamwork" is in color, with sound. It is on 16-mm film, and has a running time of 30 minutes. It's ideal for showing to distributors, die-makers, machine-tool manufacturers, heat-treaters, machinists and technical societies, as well as engineering students.

If you would like to borrow a print, write to Publications Department, Room 1000, Bethlehem Steel Company, Bethlehem, Pa., selecting a showing date as far in advance as possible.

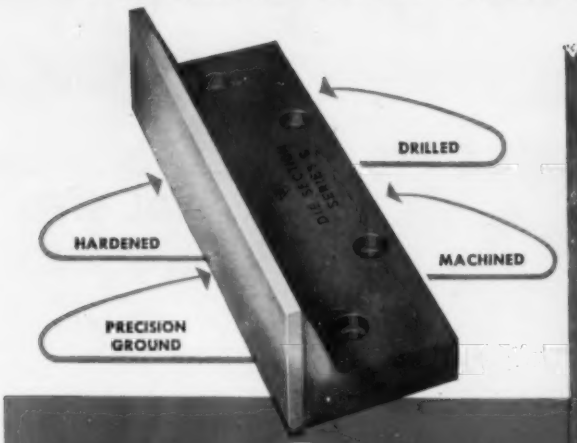
BETHLEHEM TOOL STEEL ENGINEER SAYS:

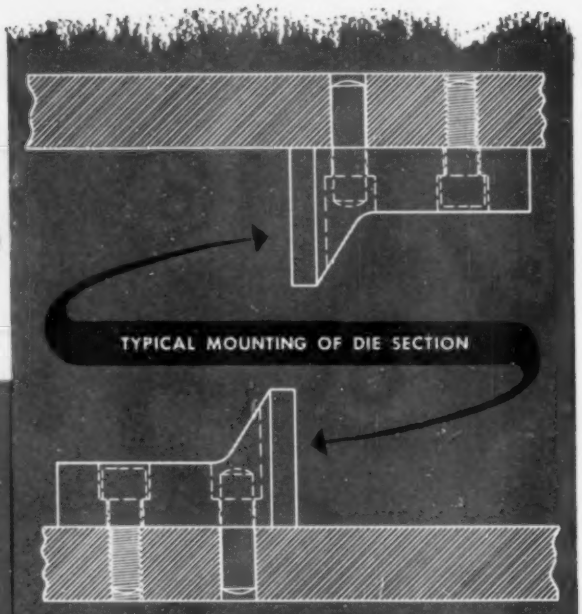
Multiple Tools Improve Hot-Work Tool Life

All hot-work tools are subject to heat-checking, a type of surface-deterioration consisting of shallow cracks, usually in network form, which lengthen and enlarge gradually during service. The cracks stem from the repeated thermal stress set up each time the tool is used. During use, portions of the tool surface are heated rapidly by contact with the work, causing expansion; subsequently natural cooling, or some type of forced cooling, causes contraction. Repeated cycles of expansion and contraction produce stresses which lead eventually to heat-check cracks which shorten tool life.

If multiple tools are used alternately, the severity of thermal stress in each operation is decreased, thus retarding heat-checking, and lengthening tool life. A typical example is in hot-piercing punches. Often as many as six punches are provided, and used alternately in a rotating fixture which permits rapid placing and removal of the tools. The life of each tool is often doubled in this manner. However, wherever multiple hot-work tools are used, some degree of improvement in tool life may be expected.

Reduce Your Die Building Time...





Standardized Die Sections

Standardized Die Sections manufactured by R-B eliminate all of your machining, drilling, hardening and grinding. For, these die sections are entirely prefabricated and ready for mounting on your die shoes . . . they will substantially reduce your die building time.

Series A, B & C die sections have cutting edges of tool steel which are hardened and precision ground. Bases are of mild steel to permit drilling of dowel pin holes.

Series AA, BB & CC die sections are not hardened, have wider lands and are of the same general construction as series A, B & C. These extra wide lands permit contouring before hardening. Die sections in both series are available in various lengths and heights.

TOOL STANDARDIZATION IS THE BASIS FOR SAVING PRODUCTION TIME. WITH R-B YOU GET THE ACCEPTED STANDARD OF THE SHEET METAL INDUSTRY—IN STANDARD DESIGN FEATURES THAT SAVE IN ENGINEERING, DIE CONSTRUCTION AND OPERATION.

4309

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STANDARD CAP SCREWS

PRECISION GROUND PARTS

SHEET METAL DIES MADE OF FERROUS ALLOYS, ZINC ALLOYS OR PLASTICS

9 design problems that can be met with the... Allenut

Ever-increasing applications for the new ALLENUT have caused sales to double within the past two years. Here are some of the things it can do to aid your product designing:

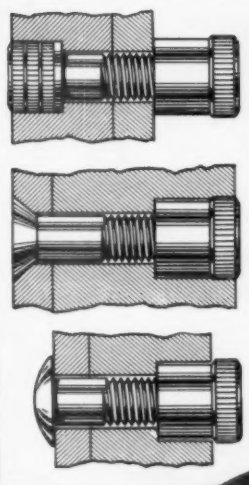
1. Self-anchoring in any metal. Allenut provides positive anchoring action through its hardened knurls.

2. Compact design. Requires no space for box wrenching. 12-point socket permits tightening in awkward places.

3. Smooth surfaces. Fits flush or below surface in counterbored hole . . . permits streamlined, safe surfaces.

4. A ready-made, hardened, tapped hole. When used as a bushing, prevents costly stripping of threads caused by frequent removal and replacement of screw or bolt. In castings and other soft metals a stripped hole can be counterbored, an Allenut inserted and the same bolt or screw used.

5. Tighter fit. Greater thread contact than with ordinary nuts because of Class 3 fit. Weld-like setups accomplished with one hand wrenching. Allenut holds firm against turn of screw.



6. Usable with any type of bolt or screw. Permits space-saving, internal wrenching of cap screws, T bolts, machine bolts, and other common fasteners.

7. Saves parts. No washers required when anchored.

8. Easier to use. Knurled ring facilitates fingering-in. Allenut is always square to counterbored hole. Removable by hitting screw or bolt head with tap of a hammer.

9. Reusable indefinitely. Anchoring action remains unimpaired. Hardened threads and socket stand up under repeated removal and replacement.

Allenuts are available in a full range of 14 standard sizes from no. 4 to 1" from leading industrial distributors.

We welcome your inquiry and request for engineering details on Allenut applications.

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Quality, speed, precision . . . yes, and profits in metalworking usually depend on TOOLING! Engineering ingenuity based on experience together with quality control in uniformity of ATRAX tooling pays dividends in production . . . dividends in quality . . . dividends in profits.

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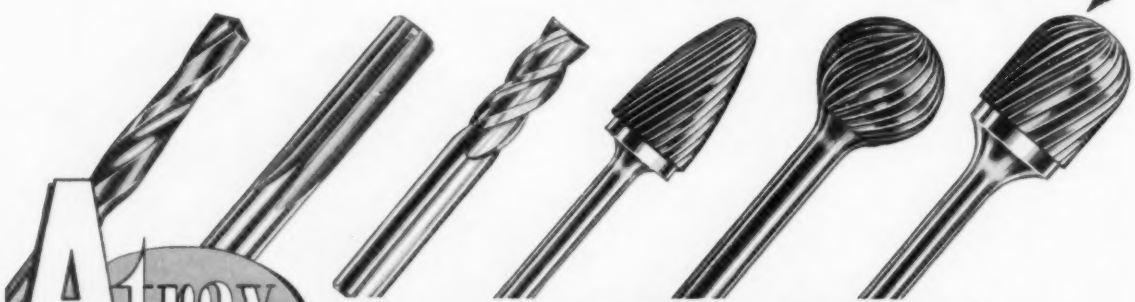

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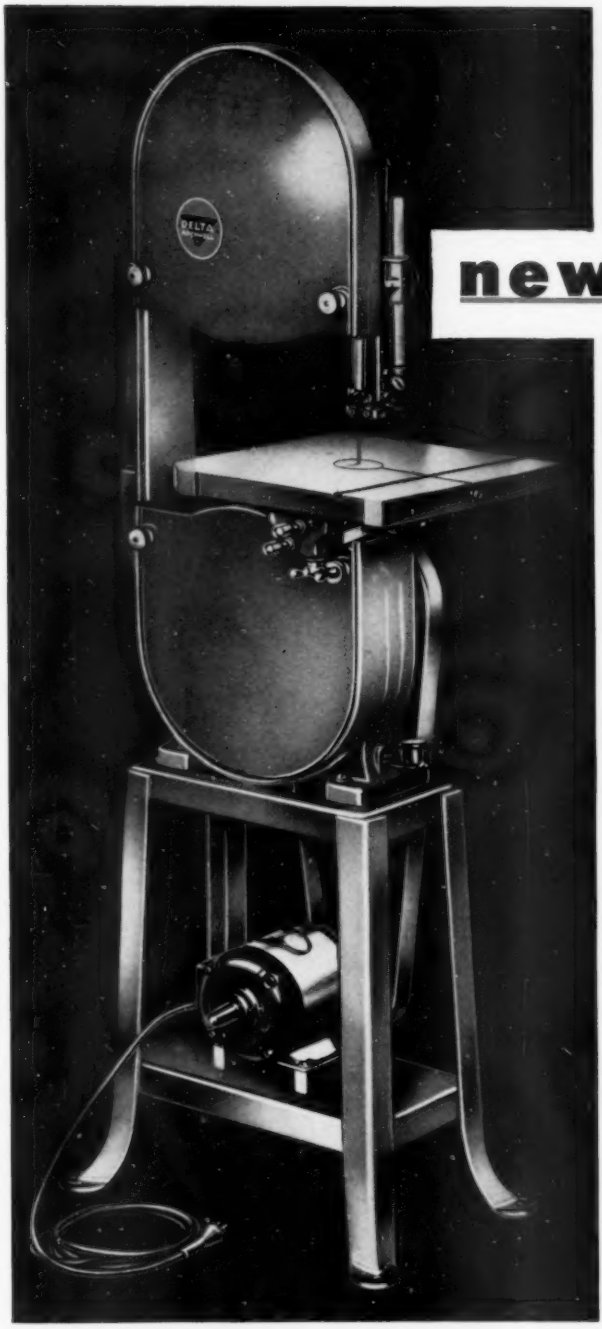

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14" metal-wood cutting band saw

All the smooth-running proved performance of the previous model—plus these new cost-cutting features make the new Delta 14" Band Saw more useful than ever:

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See the new *DELTA 14" Band Saw—try it—compare it! Get all the facts, then make up your own mind! Your Delta Dealer is listed under "TOOLS" in the classified pages of your phone book. Send the coupon for complete details.*

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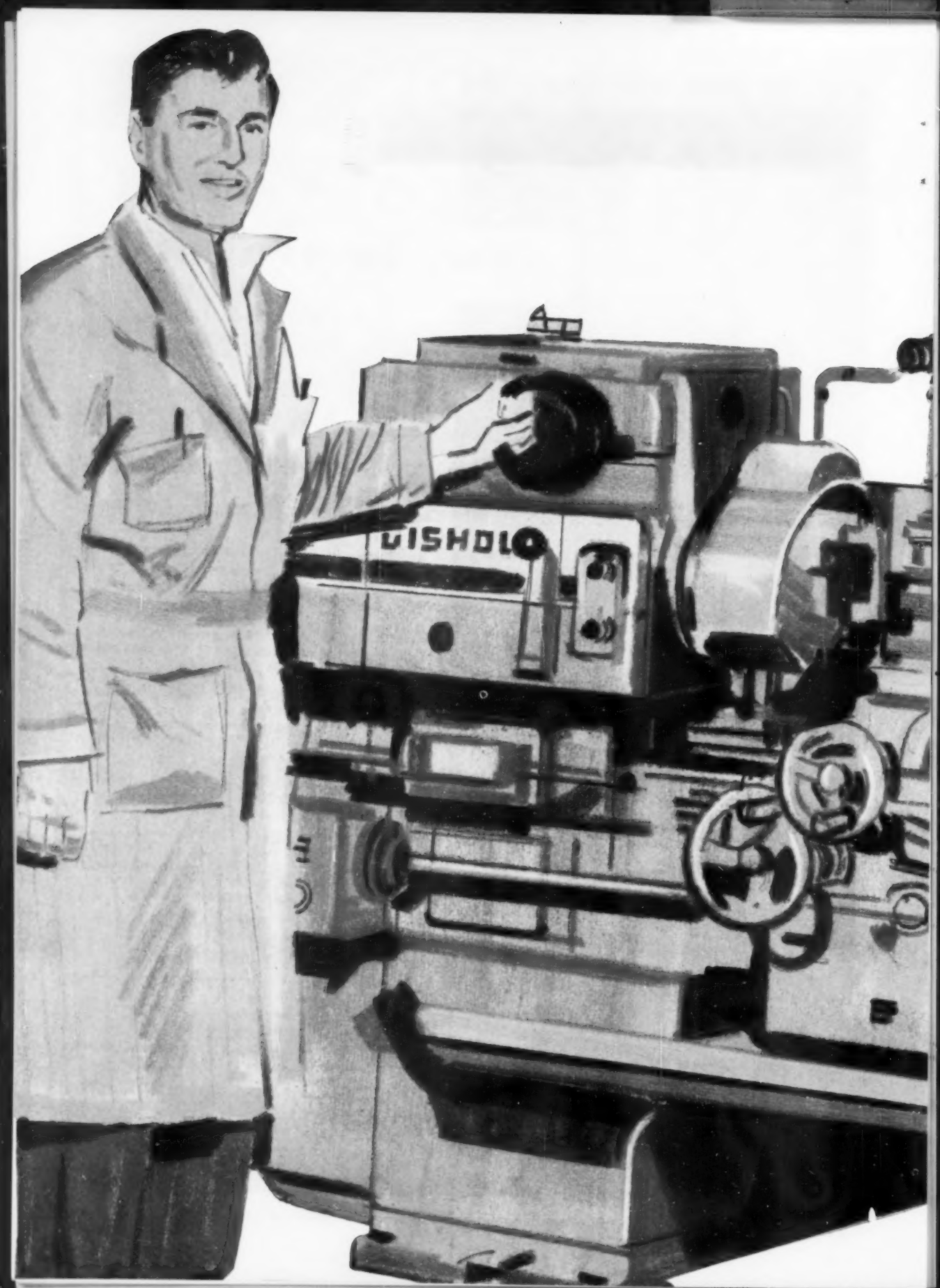
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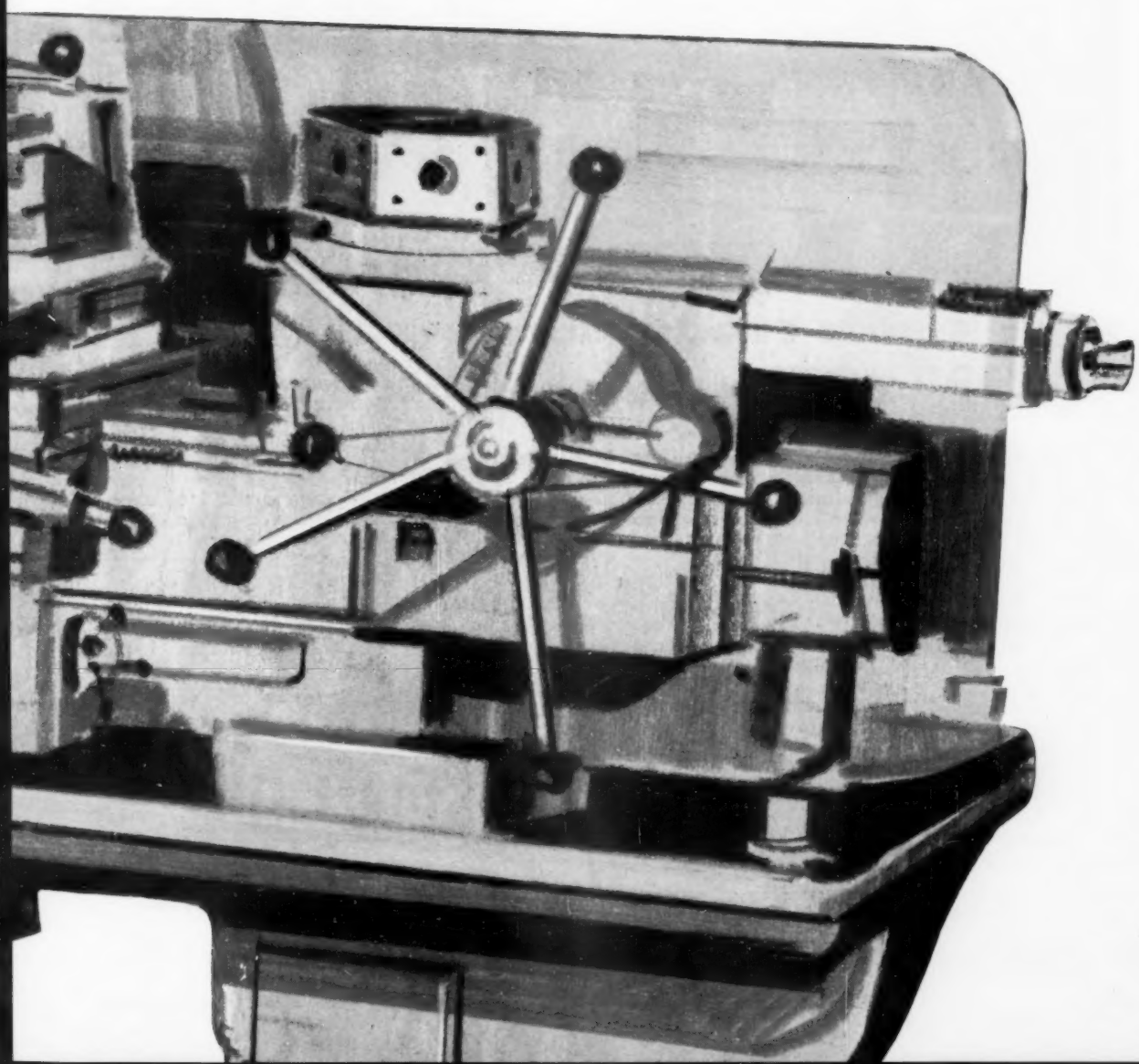
Gisholt Machine Company, Madison 10, Wisconsin

Look ahead—keep ahead—with Gisholt



High Speed Production Grinding DEMANDS more than just a Coolant!

High speed production grinding has made just *coolants* obsolete! Today's water-mix grinding fluid must provide lubrication, heat dissipation qualities, anti-rust protection and balanced surface tension. If you're using "*just a coolant*," it's costing you extra money!

Stuart's CODOL is a carefully designed liquid grinding compound that is *far more than just a coolant*. CODOL has been scientifically compounded to provide far more detergency than ordinary water-mix grinding fluids. Wheel loading is greatly reduced and allows more pieces to be ground per wheel dressing.

CODOL's carefully balanced surface tension insures the carrying away of chips and abrasive particles from the wheel, work and machine. Surface finish is improved, production is increased and good wheel life is obtained.

To be sure that you consider *all* of the important points, such as ease of mixing, resistance to rancidity, gumming and foaming, when selecting a water-mix grinding fluid, ask "the Man in the Barrel," your Stuart Representative, to call and help you. And write today for your copy of the Stuart Water-Mix Cutting and Grinding Fluid book.

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More than a "Coolant" is Needed

Stuart Oils

Time Tested Cutting Fluids and Lubricants

Plants in: Chicago, Detroit, Cleveland, Hartford, and Toronto, Ontario.

Branch Warehouses and Representatives in principal metal working centers in the United States, Canada and Europe.

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Accurate PMCo Hilo Set Plugs with "Feel" and "Snug Fit" Eliminated

The Pipe Machinery Co. Hilo Set Plugs offer new accuracy and a highly improved method for setting thread ring gages, roll thread snap gages, and other adjustable instruments for inspecting male threaded parts.

The secret behind these exclusive-design HILO plugs is two sections having different pitch diameters but with identical lead and angles. The small end is made to the extreme low limit of the ring P.D. The back end is made to the high limit of the ring P.D.

This new type plug: (a) permits the use of full prescribed tolerance for the ring itself and (b) provides positive method of sizing and setting thread ring gages, (c) entirely eliminates human errors caused by "feel and shake" methods, (d) increases speed of ring thread inspection, (e) at the same time limiting resetting to a minimum, (f) vastly improves quality of ring inspection and (g) assures a longer trouble free ring life.

Today send for details on PMCo Hilo Setting Plugs

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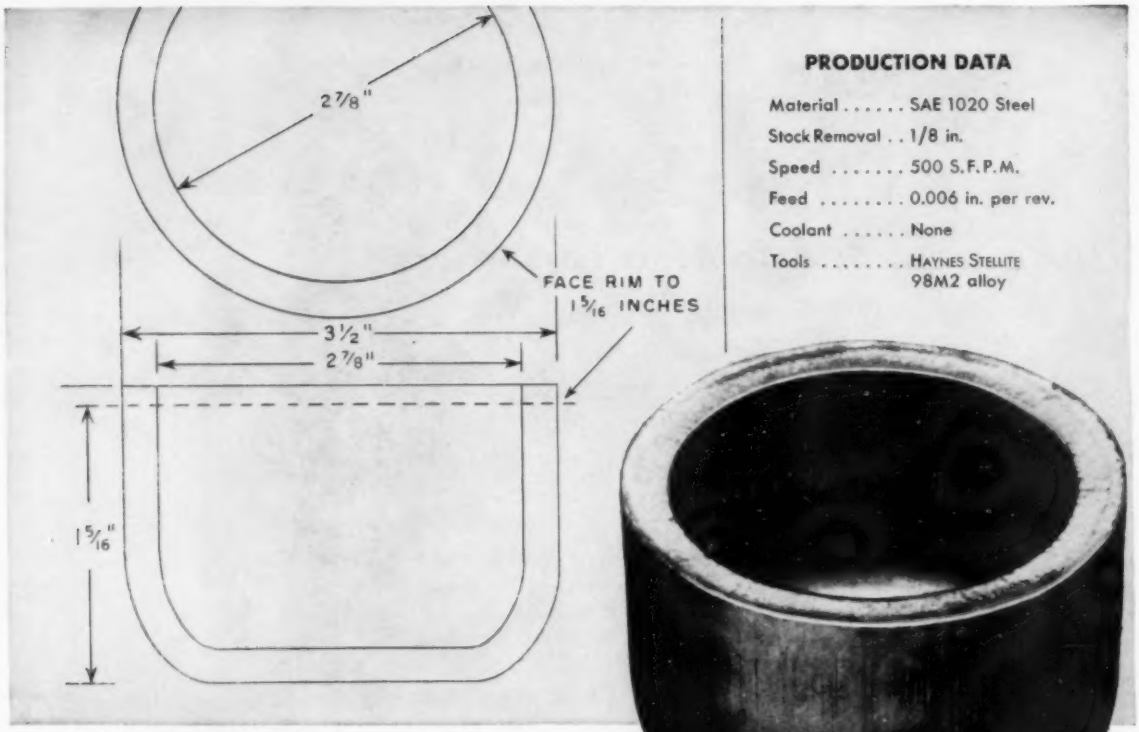
THE PIPE MACHINERY CO.

29101 Lakeland Blvd. • Wickliffe, Ohio

Greater Cleveland



PRODUCTION DATA

Material	SAE 1020 Steel
Stock Removal	1/8 in.
Speed	500 S.F.P.M.
Feed	0.006 in. per rev.
Coolant	None
Tools	HAYNES STELLITE 98M2 alloy

1,000 PIECES ▸ MACHINED PER GRIND ...despite rough, uneven cut

HAYNES STELLITE 98M2 tools machine over a thousand of these torque converter cups between grinds. The cups are deep drawn from SAE 1020 steel, and are plunge cut. The area to be machined is rough and uneven. The HAYNES STELLITE tools operate for a full eight-hour shift, at a speed of 500 surface feet per minute, without chipping or spalling. No coolant is used.

HAYNES STELLITE tools are successful on applications like this one because they have good impact strength, high compressive strength, and their cutting edges remain hard and sharp even when red hot. This same combination of properties makes them valuable on all machining jobs. They remove metal fast. They can be used at high speeds with comparatively high feed rates, and they can take deep cuts.

For information on how HAYNES STELLITE tools can help speed up your machining jobs, write for the booklet, "HAYNES STELLITE Metal-Cutting Tools." It gives helpful information on chip formation, tool design, and the machinability of metals.

HAYNES TRADE-MARK ALLOYS

HAYNES STELLITE COMPANY

A Division of Union Carbide and Carbon Corporation

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General Offices and Works, Kokomo, Indiana

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"Haynes" and "Haynes Stellite" are registered trade-marks of Union Carbide and Carbon Corporation.

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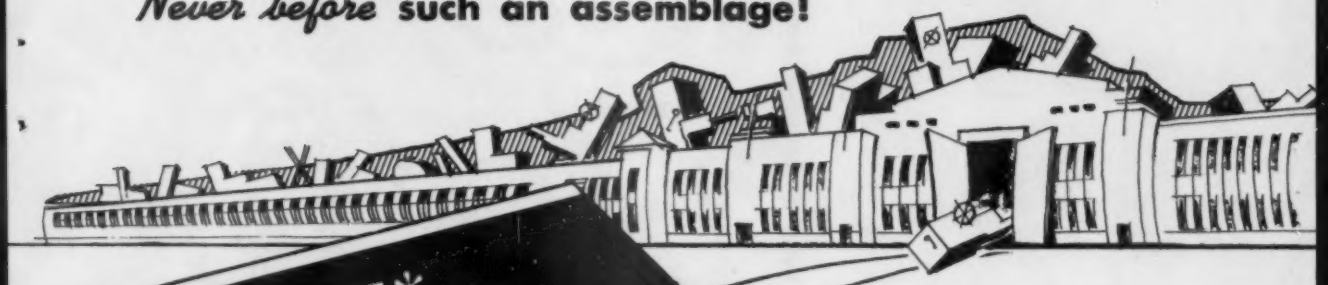

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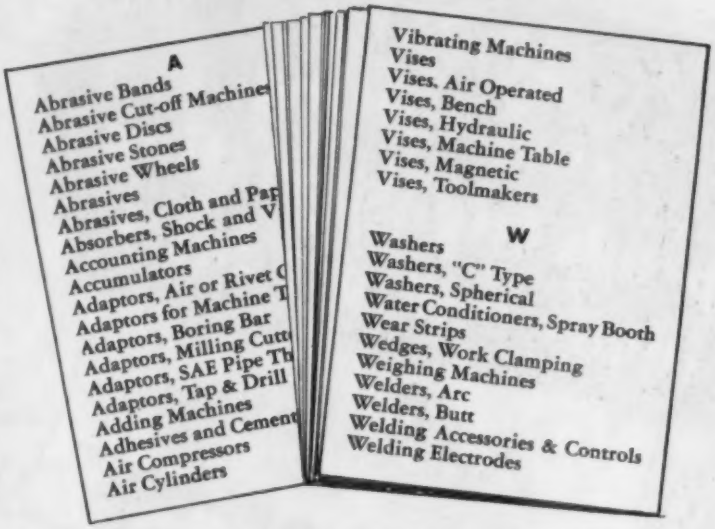

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Write for complete information today.

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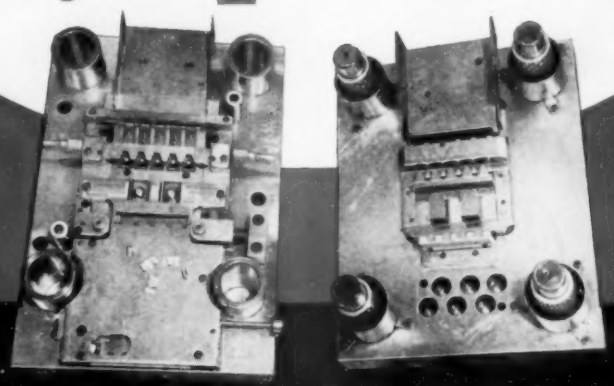
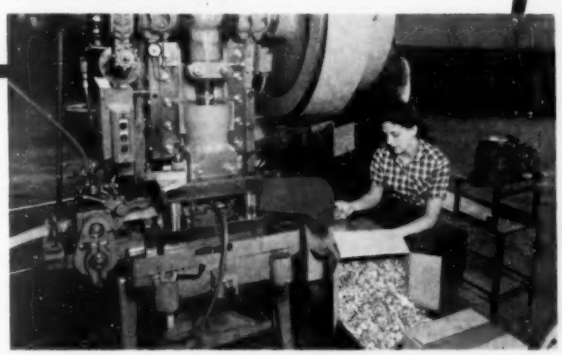


produced 68,000,000 parts . . . and ready for more!

Fisher Industries, Inc., Birmingham, Mich. used DESEGATIZED® Olympic FM die steel because . . .



1 Excellent wear resistance of Olympic FM extended the normal life of the die.

2 An estimated 25-30% savings in machining costs has been experienced with Olympic FM dies of this type.

At Fisher Industries, Inc., Birmingham, Mich., the Olympic FM die (shown above) blanks and forms universal clips from .031"-.037" zinc plated #4 Temper 1010 cold rolled steel. When photographs were taken, a total of 68,000,000 pieces had been produced on a press operating at 330 strokes per minute fabricating 5 clips per stroke.

Die makers and users throughout the metal-working industry have found that Latrobe's Olympic FM die steel consistently results in lower die production costs, superior machined finishes, and longer production runs than comparable type die steels. One of Latrobe's DESEGATIZED® steels, Olympic FM is a free-machining high carbon-high chromium die steel . . . the improved machinability characteristics resulting from the addition of alloy sulphides uniformly dispersed by the DESEGATIZED® process of manufacture.

For improved machinability and long production runs, order Olympic FM . . . Over 250 sizes are stocked in ten conveniently located warehouses.

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Main Office and Plant
LATROBE, PENNSYLVANIA

Branch Offices and Warehouses in Principal Cities

Lower Cost per piece with Surface Broaching of small parts

■ Holding fixtures are designed for quick, convenient loading, with automatic clamping and unclamping.

■ In many plants where large quantities of duplicate metal parts are being machined, substantial savings are being made through the adoption of surface broaching. Production is exceptionally high, close tolerances are maintained, and tool maintenance costs are much lower than with ordinary methods. Foote-Burt engineers, pioneers in this advanced machining method, have had a wide experience in applying surface broaching in many fields.

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Cleveland 8, Ohio
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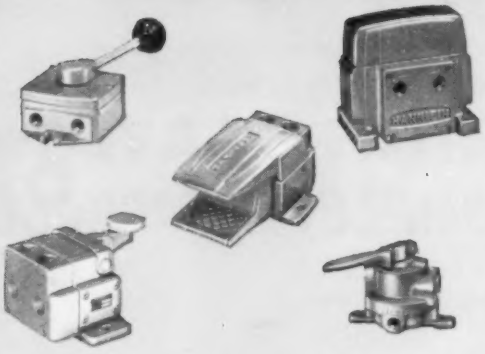
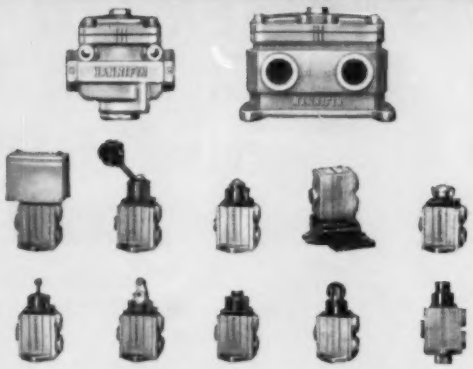
☆engineered for production

FOOTBURT

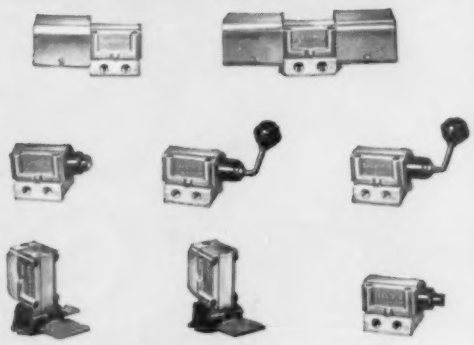
PIONEERS IN SURFACE BROACHING



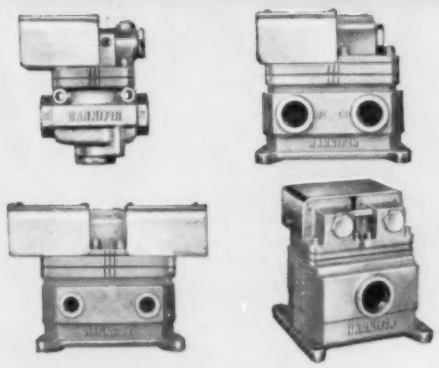
Hannifin Disc Valves. 3-way and 4-way, direct- or pilot-operated. For hand, foot or electric actuation.



Hannifin P-M Master Valves. 2-way, 3-way, 4-way. Remotely controlled from wide choice of Pilot Valves.



Hannifin P-M Direct-Operated 4-Way Valves. Small, compact, inexpensive. For every type operation.



Hannifin P-M Pilot-Master Valves. Solenoid controlled by integral pilot heads. 2-way, 3-way and 4-way.

HANNIFIN has the Air Control Valves for Your Specific Applications

Hannifin has the air control valves you need for use on your production lines or on the products you manufacture, often in a choice of types.

Shown here are typical valves from the extensive and complete Hannifin line. There's a Hannifin valve for every use from the simplest to the most complicated air-operated circuit. Singly or in combination, Hannifin valves provide hand, foot, cam, pressure or solenoid operation...in almost every pipe size.

You can simplify your air control valve problems by standardizing on Hannifin. Why not discuss your requirements with your Hannifin Field Engineer?

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STOCK DELIVERY ON ALL HANNIFIN VALVES — MAIL THE COUPON

☐ Have Field Engineer call at once

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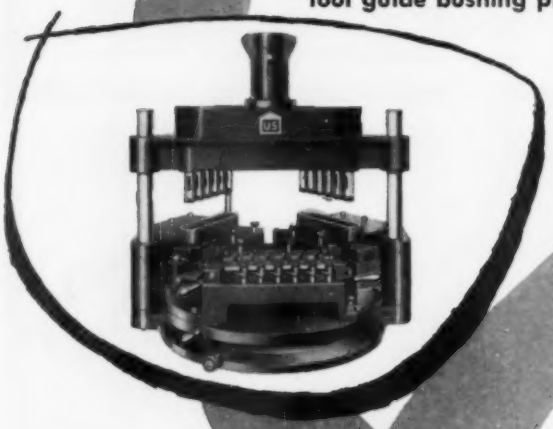
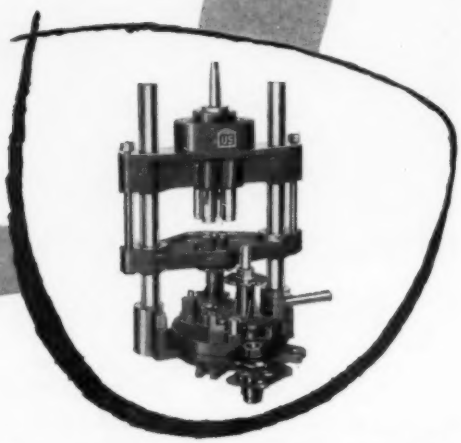
AS A COMPLETE PACKAGE

The 12-spindle unit shown below has a three-station hand-indexing table with three holding fixtures, complete with tool guide bushing plates.





Shown above is a drill head complete with boring bars with Carboloy-tipped cutters and Stellite wear strips. The indexing table has necessary holding fixtures with bushing guide plate.

The setup, left, has a two-position, hand-indexed fixture.

Write for details on any type of universal joint adjustable head. Ask also about our totally enclosed gear-driven adjustable, fixed center, or individual lead screw tapping heads.

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Wendel Research & Mfg. Corp., Albertson, New York, encountered extremely short tool life when drilling A.I.S.I. 4140 steel used in the manufacture of pilot ejection seats. They also experienced broken bits, chip welding, discoloration and burning of the tools. Shell Dromus Oil E was recommended to combat these difficulties. Here are the results:

Dromus Oil E immediately ended Wendel's trouble. The drill and steel bar stock were very cool and easy to handle. Chip settling was excellent, and discoloration of tools and work was completely eliminated.

Here are some of the outstanding features of Dromus Oil E:

1. Excellent wetting and cooling properties—wets all metal surfaces extremely fast.
2. Provides longer tool life—better finish.
3. Not sticky or greasy—keeps tools and work exceptionally cool.
4. Forms a solution, not an emulsion . . . is stable in any concentration.
5. Easy to mix in hot or cold, hard or soft water.

Write for information on Shell Dromus Oil E. See how it can help you increase tool life.

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SHELL

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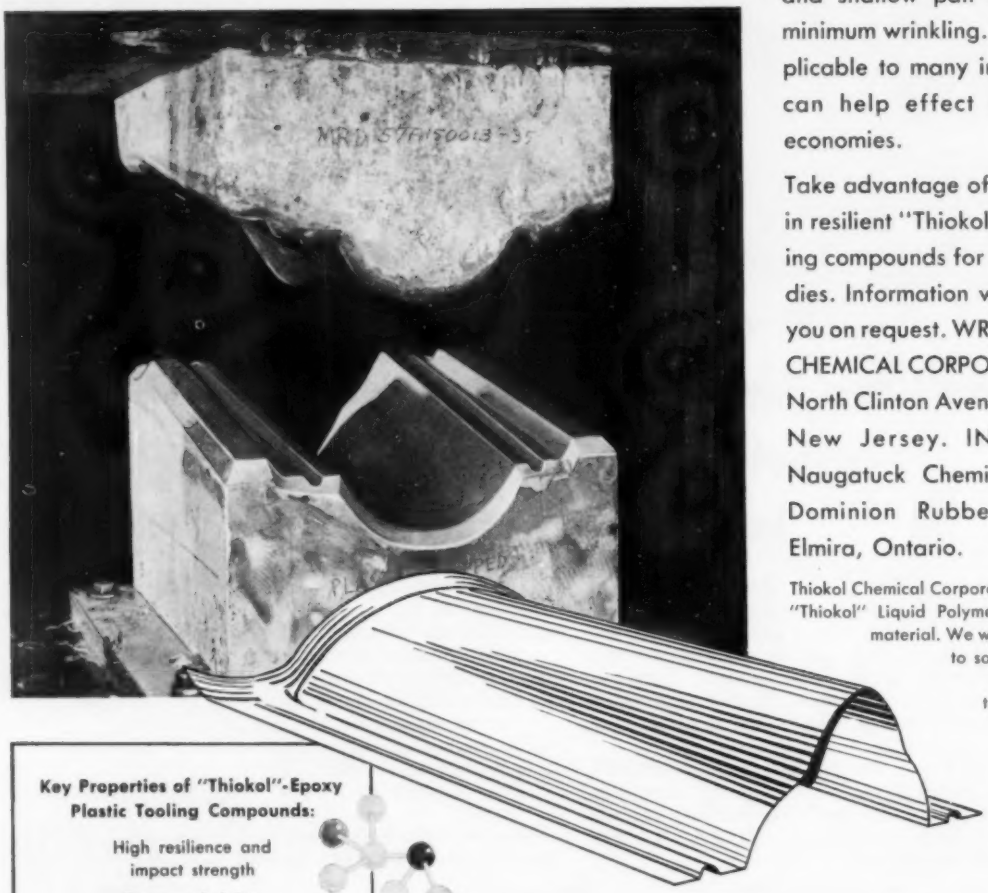
The dies are constructed of Kirksite bodies capped with a layer of the resilient tooling compound. The caps are easily cast at room temperature to exact finish contour . . . eliminating the labor of hand grinding and scraping. Dies capped with resilient "Thiokol"-epoxy compounds produce duct halves, beads, angles, channels and shallow pan sections with minimum wrinkling. They are applicable to many industries and can help effect real tooling economies.



Take advantage of the economy in resilient "Thiokol"-epoxy tooling compounds for drop hammer dies. Information will be sent to you on request. WRITE: THIOKOL CHEMICAL CORPORATION, 784 North Clinton Avenue, Trenton 7, New Jersey. IN CANADA: Naugatuck Chemicals Division, Dominion Rubber Company, Elmira, Ontario.

Thiokol Chemical Corporation manufactures "Thiokol" Liquid Polymer only as a raw material. We will gladly refer you to sources of supply of "Thiokol"-epoxy tooling compounds.

Key Properties of "Thiokol"-Epoxy Plastic Tooling Compounds:

High resilience and impact strength

Easy workability

Room temperature processing

Exact reproduction

Outstanding adhesion

Thiokol®

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ROTATING CUTTING TOOLS CARBIDE-TIPPED

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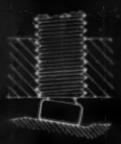
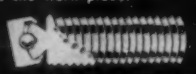
VLIER® SWIVEL-PAD® CLAMPS

Now Available in 2 Types!

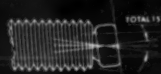
Both types have these outstanding features!



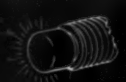
- Screw torque absorbed by pad—not the work piece.



- Unique ball-joint construction provides extremely smooth angle adjustment and rotation of pad.



- Pad swivels 7½° each side of center line in all directions.



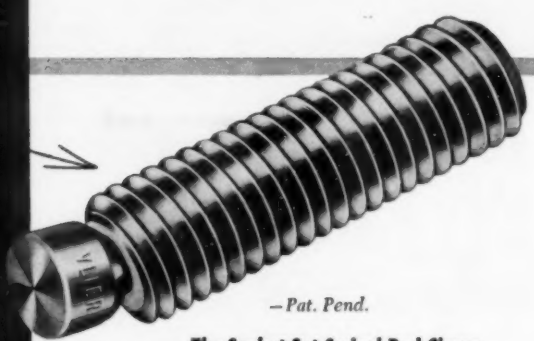
- Large flat pad area assures tighter clamping.

- Conical seat distributes clamping pressure uniformly.
- Eliminates costly, custom-made swivel pads.
- Du-Lite finish for rust proofing.
- Made from heat-treated, alloy steel to last for years.

—*Pat. Pend.*

The new Knurled Head Swivel-Pad Clamp

Use when finger-type clamping is sufficient. Wide knurled-head gives good gripping; assures fast screw run-in. Available in 4 different screw diameters; 1½" and 2" screw lengths.



—*Pat. Pend.*

The Socket Set Swivel-Pad Clamp

Use wherever maximum rigidity is necessary, or where space is limited. Available in 7 screw diameters; various lengths.

Write for free 1956 Vlier catalog.

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NEW ROTOR IMPACT WRENCH

FAST. Powerful air tool. 2100 solid blows per minute set nuts in a hurry. Reversible for removing nuts.

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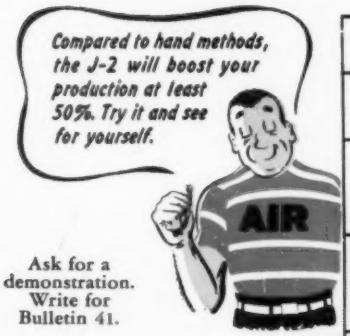
LOW MAINTENANCE. Fewer parts . . . some interchangeable . . . some reversible. Steel clutch housing. Rugged throughout.



Ask for a demonstration. Write for Bulletin 41.

SPECIFICATIONS

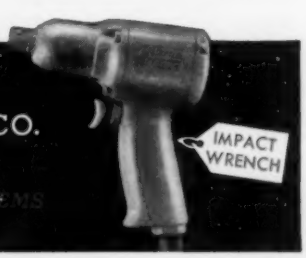
MODELS	Blows per Minute	Length	Weight	Square Drive*	Side to Center	Hose Connection	Rated Capacity. (Bolt Size)
J-2-S Side Handle	2100	6"	3#	½"	1⅛"	¼"	¼"
J-2-L Lever Handle	2100	7¾"	3¼#	½"	1⅛"	¼"	¼"

*⅜" square drive or ⅞" Quick-Change Chuck is optional.

THE ROTOR TOOL CO.

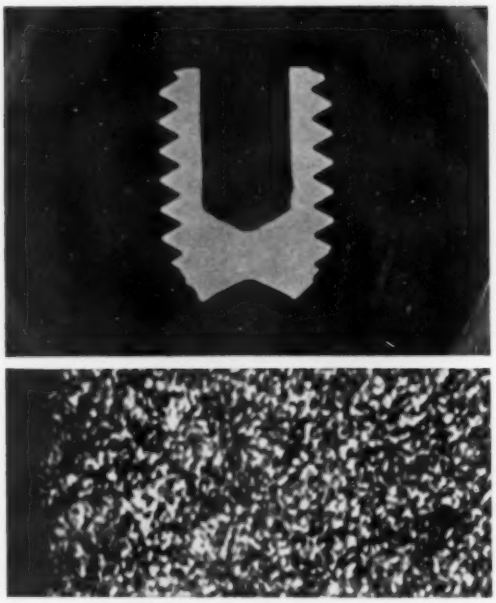
CLEVELAND, OHIO

UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS

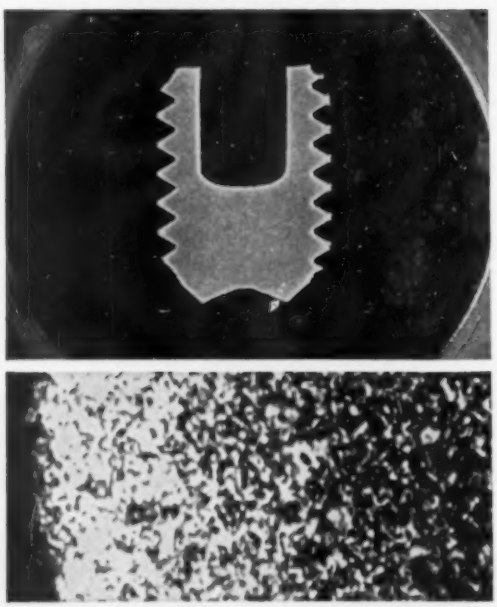


New heat-treatment methods help High-Torque Unbrako socket set screws withstand up to 40% Higher Torques

UNBRAKO SET SCREW



ORDINARY SET SCREW



—you can set them and forget them

Research had proved that the tighter you seat a set screw the better it works. So we developed a set screw that could be tightened tighter than ever before without damaging the screw. One of the problems was developing new methods of heat treatment to eliminate decarburization. Decarb of course plays havoc with a screw. Put a wrench in the socket and you ream it. Run the screw into a tapped hole and you strip its threads. Try to seat it and its point shears off. These photographs are a study in contrasts. The UNBRAKO is clean, its grain uniform. There is no decarburization —the ordinary set screw is suffering from an overdose of it, socket walls, threads and point are full of the telltale white spots.

You can't buy a better screw than an UNBRAKO. And you can't get full *high-torque* performance without a "High-Titan" UNBRAKO Hex Key—the high-ductility, precision internal wrenching tool. See your industrial distributor. Or write STANDARD PRESSED STEEL CO., Jenkintown 37, Pa.

RECOMMENDED SOCKET SET SCREW TIGHTENING TORQUES (Inch-Pounds)

SCREW SIZE	UNBRAKO	SET SCREW B	SET SCREW C	MINIMUM DIFFERENTIAL %
#4	5	3.9	3.5	28
#5	9	7.8	7.4	15
#6	9	7.8	7.4	15
#8	20	14.7	14.5	36
#10	33	26.5	25	25
1/4	87	62	60	40
5/16	165	122	125	32
3/8	290	198	225	29
7/16	430	309	350	23
1/2	620	460	500	24
5/8	1225	1106	1060	11
3/4	2125	1540	1800	18
7/8	5000	3660	4600	9
1	7000	5025	6500	8

STANDARD PRESSED STEEL CO.

UNBRAKO SOCKET SCREW DIVISION SPS

JENKINTOWN PENNSYLVANIA

DIFFICULT JOBS ARE *routine on* DE VLIEG *SPIRAMATIC* JIGMILS®

PHOTO COURTESY OF DANROY BORING CO.

DeVlieg *SPIRAMATIC* JIGMILS® permit accurate machining of workpiece from 4 sides at 1 setting!

The above photograph, taken in a well known Detroit Tool Shop, illustrates a Special Hydraulic Fixture being machined on a DeVlieg Model 3B-48 *SPIRAMATIC* JIGMIL. This job was completely machined on four sides at one setting to precise limits of accuracy and operations included drilling, boring, milling and O.D. turning 22" diameter trunnion.

Come to Detroit...

See a practical demonstration of the JIGMIL Technique

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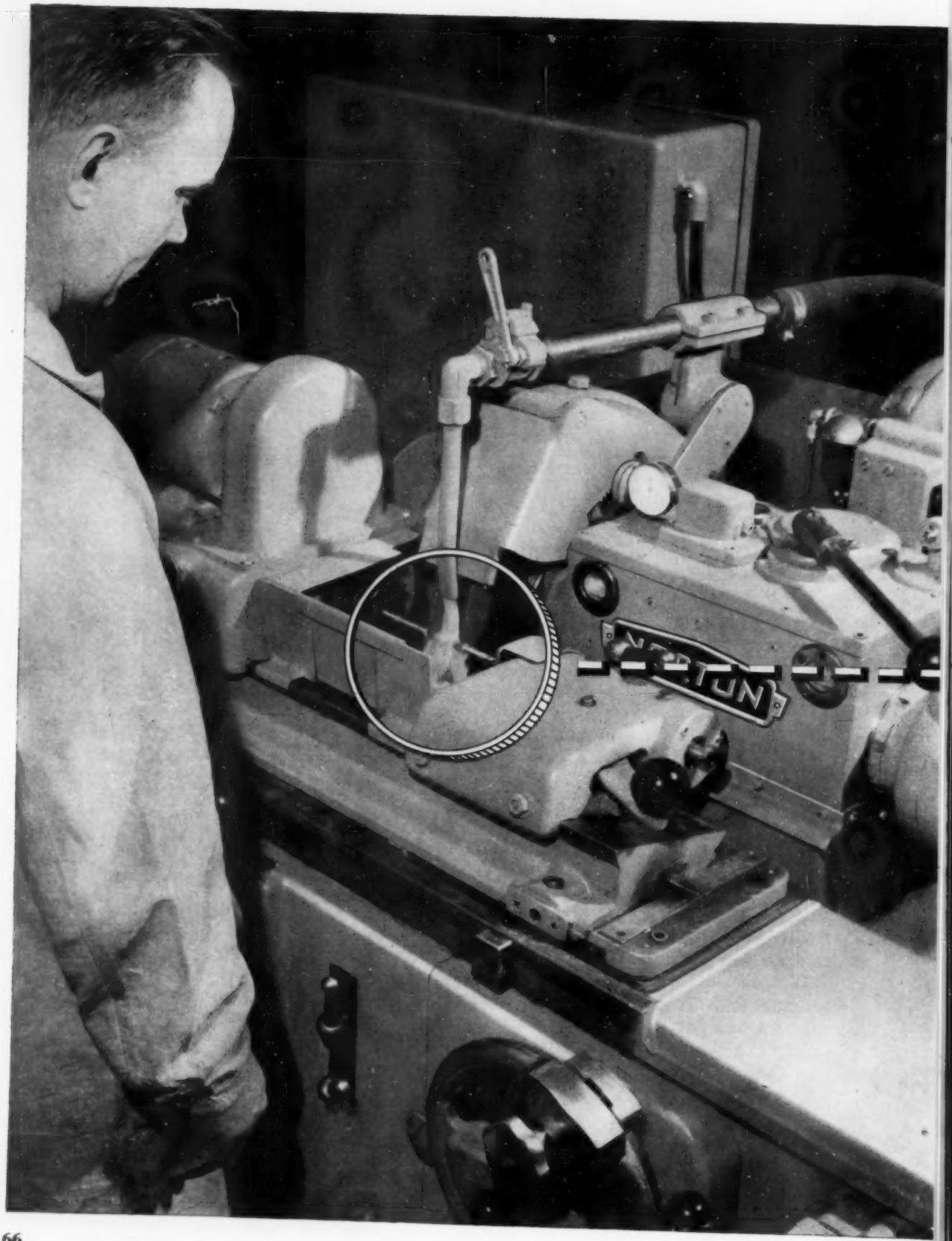

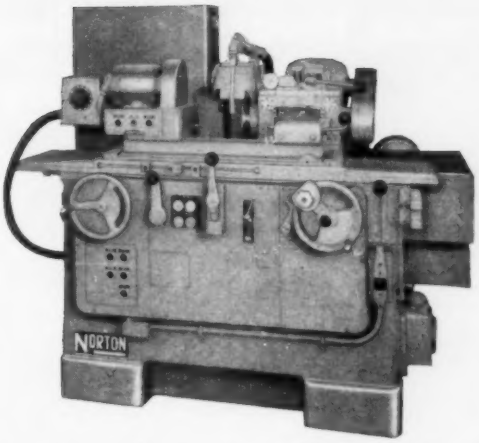

New Norton 4"x18" Type CTU Cylindrical Grinder

gives you high precision plus high production . . .

makes small parts pay off big

Here's a cylindrical grinder you can get as either a Plain Machine for traverse work, or as a Semiautomatic for plunge operations.

Either way you get faster, more accurate, more profitable grinding of a wide variety of small parts. Because either way the 4" Type CTU's Norton-developed features bring a new ease of operation for your men — and a new high in production quality and quantity for *you*.

To name just one of these advanced features, there's the extremely rugged wheel spindle unit that assures enduring precision in jobs ranging from heavy stock removal to fine finishing. Then there are optional profit-boosting extras like the new SWIVALIGN Dual Electric Indicator for measuring swivel table adjustment, and an Automatic Wheel Truing Device. But why not get the whole story of this speedy, profit-boosting grinder from your Norton Representative or write for Catalog No. 531.

The Norton Lease and Purchase Financing plans enable you to modernize while conserving your capital, and remember: only Norton offers you such long experience in both grinding wheels and machines — to help you produce better products at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass.

To Economize, Modernize With NEW

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GRINDERS and LAPPERS

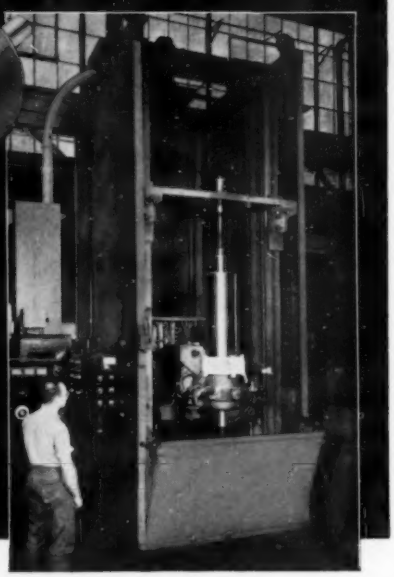
Making better products . . . to make other products better

District Sales Offices: Hartford • New York • Cleveland • Chicago • Detroit • *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5, Ontario

Former Heat-Treating Time—28¼ HOURS
TOCCO Heat-Treating Time—30 MINUTES

Plus

$108 saved on every mill roll



This special mill roll hardening fixture is powered by two 200-KW, 3000 cycle TOCCO machines. Mill roll shown is 12" diameter by approx. 60" long.

with TOCCO* Induction Heating

When progressive engineers at The McKay Machine Company switched from conventional heat-treating methods to TOCCO induction hardening of their mill rolls, they achieved not only increased production but also important cost savings, and perhaps most important of all, a greatly improved product.

56 Times as Fast!

Formerly mill rolls required a 12-hour heat, a 15-minute salt brine quench, 12 hours tempering and a 4-hour cooling period. With TOCCO the whole job is done—and done better—in just 30 minutes—56 times as fast!

Here's Real Economy

Reduced furnace time saves $28.00 per roll. More important, grinding time is cut in half (saving $80 per roll) because TOCCO minimizes distortion and there's less stock that must be removed. Runoff used to be as much as ¼"—frequently requiring a separate straightening operation.

Product Improved

Because TOCCO "scans" the mill roll, i.e. heat treats it progressively, only a small section is at critical temperature at any one time. That's why distortion is minimized and little finish grinding is required. This means that TOCCO-hardened mill rolls have a *more uniform case-hardened depth* than possible with old fashioned methods which in turn means longer life and better performance.

• • •

Why not have a TOCCO engineer survey your plant to determine where TOCCO can reduce your costs, increase production speed and improve product quality?

THE OHIO CRANKSHAFT COMPANY

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The Tool Engineer

National Engineers' Week

Long before he became a military leader and the president of the United States, George Washington had, as a land surveyor at the age of sixteen, left his mark as an engineer on the early development of America. It is only fitting that the National Society of Professional Engineers has chosen the occasion of his birthday for the past several years to salute the engineers of this country. The week of February 20-26 has been proclaimed National Engineers' Week by the president of the United States, the governors of most states and the mayors of hundreds of cities.

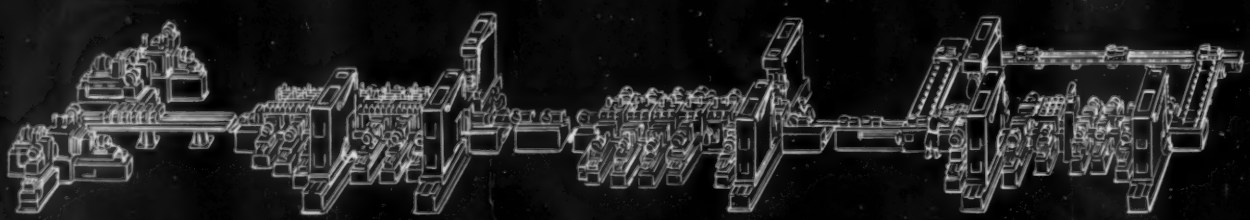
We of the American Society of Tool Engineers join in paying tribute to engineers in all fields for the contributions they have made to our American way of life. It is largely because of them that we enjoy the highest standard of living in all the world. Our special thanks go to the many chapters of ASTE who are taking an active part in helping celebrate National Engineers' Week in their own communities.

H. B. Osborn Jr.

PRESIDENT

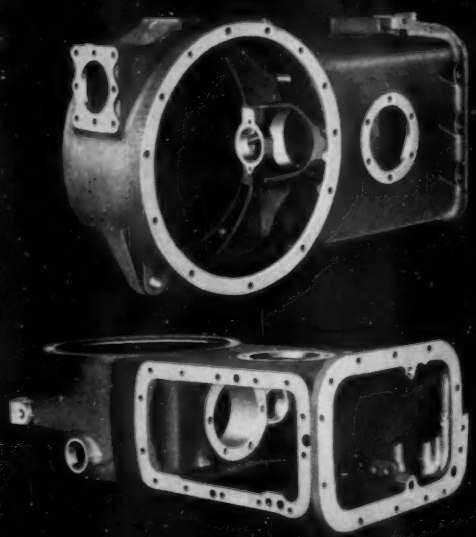
Tractor Differential Housings from Rough Castings to Assembly!

Another Transfer-matic by Cross



The new Cross Special Machine above is one of four sections which constitute a complete production line. Together, they process 46 tractor differential housings per hour from rough foundry castings to assembly. The line is 225 feet long with 31 stations. It performs 313 operations, including 19 milling, 7 cross-facing, 110 drilling, 17 boring, 72 chamfering, 4 spot-facing, 8 reaming and 76 tapping.

Like all Cross machines, the parts—even tooling details—are made to interchangeable tolerances for fast, easy maintenance and to provide flexibility for model changes—an important Cross advantage both from the standpoint of operating costs and investment. This production line is another example of Cross Sectionized (Segmented) Automation.



Established 1898

THE CROSS CO.

First in Automation

DETROIT 7, MICHIGAN

Fig. 1. General view of rebuild shop in which many parts of machines are made and others rebuilt to give extended service.

initiating a dynamic

Machine Rebuilding Program

By James Obrecht
Supt., Mechanical Maintenance
Boeing Airplane Co.
Wichita, Kansas

OVERTAXED SCHEDULES of machine rebuilders and manufacturers provided officials at Boeing-Wichita with the impetus needed to organize their own machine rebuilding program. Most of the machine tools in the plant had been subjected to excessively hard use and were, in many instances, approaching the end of their normal life expectancy. To attain a flexible production schedule in the plant, it was necessary to replace obsolete equipment and restore worn machines to first-class condition.

A study of the machines was made by a team of Boeing supervisors representing the methods engineering, plant planning and the maintenance departments. This group inspected and analyzed all of the used machine tools. Examinations of maintenance and production records were made and interviews with operators of the equipment were achieved whenever possible. Individual reports on each machine were prepared by a Determination Committee which reviewed the information compiled by the teams that had made the study. Included on the Determination Committee were members of the manufacturing division, the maintenance department and the facilities department. As a result of this wide representation, the report on each machine set forth the following analytical information:

1. Year machine was built.
2. Acquisition cost.
3. Description of repair work necessary.
4. Recommendation for rebuild or replacement action, including estimated cost.

While the Determination Committee was making its report, it was suggested that repair or replacement be done under one of the following programs:

1. Rehabilitation in Boeing shops.
2. Send to a machine tool rebuilder.
3. Send to original manufacturer for overhaul.
4. Replace with a new machine.

The last program would apply only if the rebuilding cost would equal 60 to 70 per cent of the cost of a new machine.

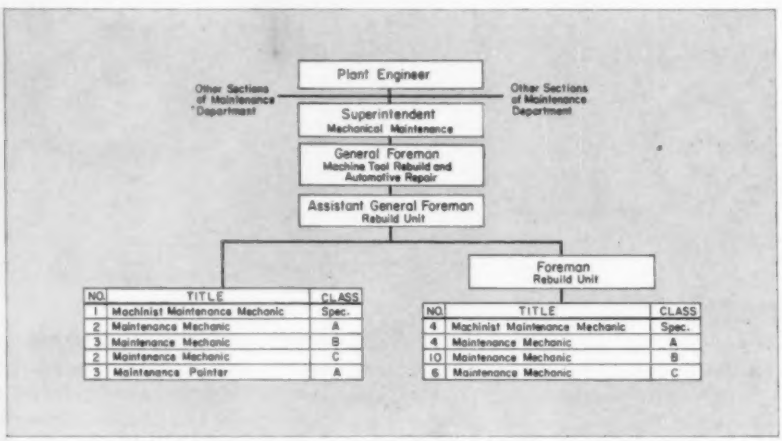
The average age of the 425 machines under study was 8.3 years and the condition varied from poor to excellent as follows: 18 percent poor, 25 percent fair, 54 percent good and 3 percent excellent.

Estimates on costs for rebuilding machines at the Boeing plant were based on a rate of 30 percent of the original cost. This was later shown to be high, as figures indicated a rebuilding cost of only 23 percent. On estimates concerning work to be done by machine tool rebuilders, the cost was computed at 30 percent of the original cost of the machine, plus cost of parts. For the prices on rebuilding by machine tool manufacturers, actual quotes were given, in most instances, by the machine tool manufacturers themselves.

In addition to the excessively high cost of taking the work outside the plant, most of the rebuilders and manufacturers were not receptive to adding work to their already heavily taxed schedules. However, they did offer their assistance in giving technical advice wherever it was needed. This reinforced the decision to do all the work at Boeing.

In the meantime, Boeing started to acquire equipment for this program and made space available in the plant to begin work on rebuilding machine tools. A preliminary list of equipment was prepared and a centrally located area 75 by 100 feet was provided. This area, *Fig.* 1, had immediate access to the maintenance machine shop and the electrical rebuild and rewinding shops. A paint room was provided by converting an existing aircraft engine washroom adjacent to the shop area. As soon as a portion of the equipment needed for efficient operation of the rebuild shop was received, work was begun on a standby mill.

It must be mentioned that the production departments did not, at first, accept the rebuilding program enthusiastically. They were reluctant to see any machine tool taken out of production for any reason except a major breakdown. To minimize rebuild costs and to plan parts procurement to coincide with scheduled availability of the machines, the maintenance department wanted to schedule machines for rebuild before major breakdowns occurred. Also, the production departments were somewhat inclined to doubt the capabilities of the newly organized and inexperienced rebuild shop. These difficulties were overcome by increasingly


Plant Engineer
Other Sections of Maintenance Department
Other Sections of Maintenance Department
Superintendent Mechanical Maintenance
General Foreman Machine Tool Rebuild and Automotive Repair
Assistant General Foreman Rebuild Unit
Foreman Rebuild Unit

NO.	TITLE	CLASS
1	Machinist Maintenance Mechanic	Spec.
2	Maintenance Mechanic	A
3	Maintenance Mechanic	B
2	Maintenance Mechanic	C
3	Maintenance Painter	A

NO.	TITLE	CLASS
4	Machinist Maintenance Mechanic	Spec.
4	Maintenance Mechanic	A
10	Maintenance Mechanic	B
6	Maintenance Mechanic	C

Fig. 2. An analytical chart showing personnel assigned to the rebuild and the line of authority to the plant engineer.

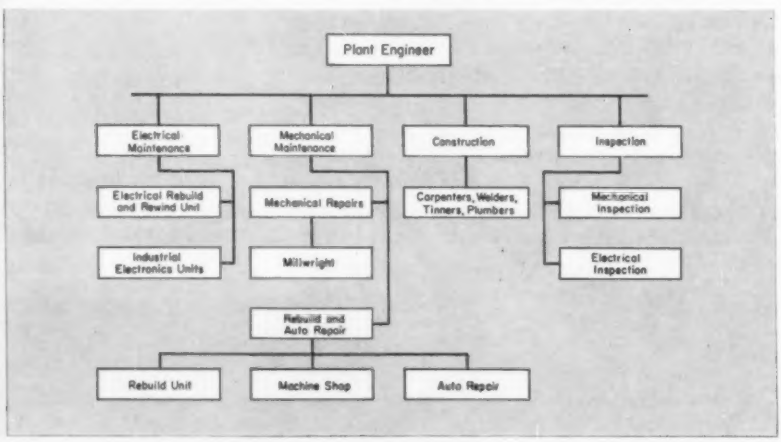


Fig. 3. Breakdown of maintenance department units supporting machine tool rebuild program.

DATE	MAINTENANCE WORK PERFORMED	WORK ORDER	HOURS LABOR	HOURS DOWN	PARTS COST

SHEET 1

EQUIPMENT MAINTENANCE RECORD

USAF NO. _____

DESCRIPTION _____ DATE _____ OTHER IDEN. #_____

MFRS. NAME _____ ADDRESS _____

SERIAL NO. _____ YR. MFG. _____

MODEL NO. _____ SIZE & CAPACITY _____

MUNITIONS BD. CODE _____ PRESENT REPL. COST _____

DATE				
ORDERED _____ RECEIVED _____ INSTALLED _____	WIDTH _____ DEPTH _____ HEIGHT _____	WEIGHT _____ EXHAUST _____ AIR _____	WATER _____ GAS _____ STEAM _____	

LOCATED IN DEPT	TRANSFERS	DATE	TO	DATE	TO	DATE	TO

LUBRICATION	BEARING DATA	PRINTS, INST MANUALS AND PARTS LISTS

MOTOR RECORD

MFG.	H.P.	R.P.M.	TYPE	MOTOR	FRAME	STYLE	SR. NO.	MODEL	PH.	VOLT	AMP

CYCLE	CONT. EQUIP.	DRIVE	BELTS		TYPE BEARING	BEARING DATA

Fig. 4. (Above.) Front and reverse side of form used by the maintenance department to provide pertinent operating information.

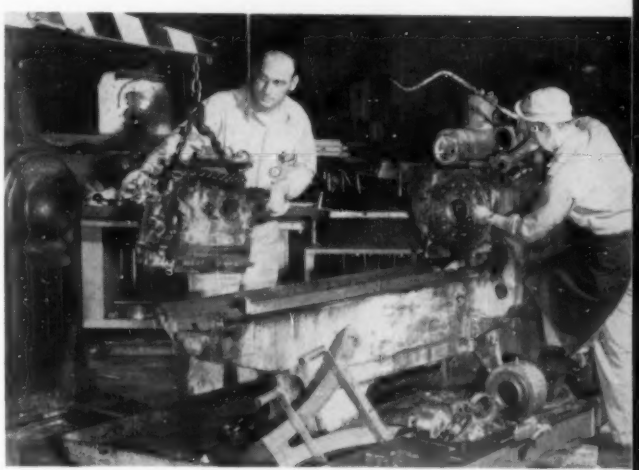


Fig. 5. (right) A turret lathe being disassembled for cleaning and inspection prior to complete rebuilding.

improved coordination between production planning and rebuild planning, and by the high-quality performance of rebuilt equipment placed back in service.

With the establishment of the policy for operating a rebuild shop as such, the maintenance department was confronted with the problem of obtaining experienced personnel. There were no employees in the department qualified in machine tool rebuilding, and supervision had only the experience gained in visits to other departments where rebuild work was being done. At no time during the program has the department been able to hire qualified rebuild mechanics even though an aggressive recruiting campaign was conducted.

The method of providing personnel was to select a maintenance mechanic or machinist and provide him with detailed supervision and assistance on his assignments in the rebuild shop. Allowing him ample opportunity to observe the work of others before going on his own, he is converted to a competent rebuild mechanic. On the supervisory level, training consisted of visits to the shops of machine tool manufacturers and rebuilders, affording opportunities to observe operations of and have conferences with experienced personnel. An extensive library was established, containing thorough collections of manufacturers' instruction books, manuals, drawings and other pertinent information necessary to the successful rebuilding of machine tools.

Experience and the advice of commercial tool manufacturers and rebuilders indicated that the best work is done when a single group of men does all the work on one machine. One shift of 35 men forms the working force of the rebuild unit. These men report to the plant engineer through the chain of command, *Fig.* 2.

Inasmuch as there are operations other than mechanical work involved in the rebuilding process,

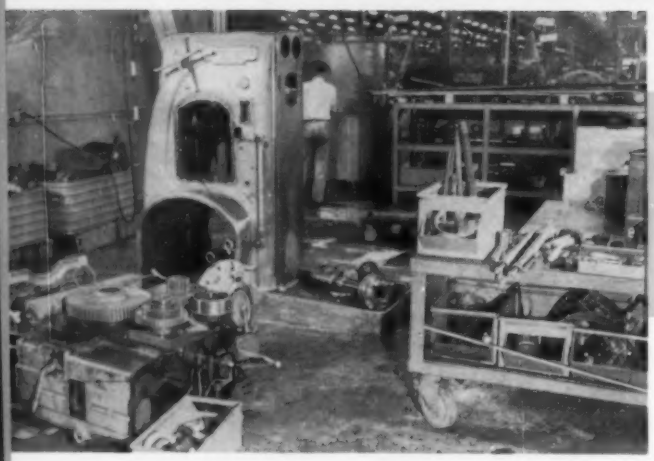


Fig. 6. (upper left) Electrical components are checked or rebuilt in a separate section adjacent to the rebuild shop.

Fig. 7. (upper right) Rescraping the ways of a vertical mill. Note the special straightedge used to check the work.

Fig. 8. (left) Component parts being readied for assembly.

supporting groups were established to afford additional assistance in completely rebuilding a machine. An organizational chart showing these groups can be seen in *Fig.* 3.

The maintenance department stock cribs carry minimum stock levels on approximately 23,000 common repair parts used by the rebuild unit, electrical rebuild shop and regular maintenance repair crews. The stock was built to its present level on the basis of requests from supervisors involved, who specified the original requirement and the estimated level to be maintained for each part. A perpetual inventory record is used to determine when replenishment is necessary and to establish an experience rating for each part. A maintenance parts planner coordinates and places all special orders for the stock cribs with representatives of the purchasing department.

To establish an operation procedure to evaluate machine tool condition, the maintenance department established an extensive preventive maintenance program that provides continuous surveillance of equipment. A standard form, *Fig.* 4, provides such information as description of the machine, pertinent maintenance and repair work that has been accomplished since its installation, and an analysis of the cost of the work. By studying this form it can be determined when repair costs and shutdown time have become excessive enough to warrant complete rebuilding.

When it becomes known that a machine is to be rebuilt, a work order request is submitted to the cost accounting department, showing the name and number of the machine as well as estimated costs. When the work order is received from cost accounting, all departments in the rebuild unit coordinate activities to be ready for rebuilding the machine as soon as shutdown occurs and the millwrights deliver the machine. Large machines are rebuilt where they stand.

As soon as machines are received in the rebuild unit they are assigned to one of five specialists who follows the job through to completion. He checks work and makes routine assignments in addition to doing the most complex jobs himself. All machines are completely disassembled, *Fig.* 5. As each part is removed it is cleaned in solvent and checked for wear and general condition. Worn parts are checked against stock lists and if not in stock an expedited purchase order is placed. If parts are not immediately available, an order is placed with the maintenance machine shop to fabricate the part. Special bins are allotted each machine and, as parts are made available, they are checked off the parts list and placed in the bin. Machine parts that are approved for reuse are also placed in this bin.

Castings are steam cleaned and, when indicated by performance records or visual inspection, are checked for cracks or faults by application of a penetrant. Parts that require machining are listed

and sent to the machine shop accompanied by a working sketch to show exact tolerances desired. Electrical components are delivered to the electric shop for rebuild work, *Fig.* 6, that may be necessary.

All wearing surfaces of the machine—including tables, columns, knees and saddles—are checked against manufacturers' specifications and with related machine parts. Parts are ground, removing the amounts of metal indicated on the sketches.

Mating parts that form bearing surfaces are hand scraped, *Fig.* 7, after first checking each part with a straightedge or a surface plate. When the amount of metal removed from a surface is sufficient to throw the machine out of alignment, one of the mating surfaces is built up with laminated phenolic strips. This surface is again machined and scraped to a bearing with the mating surface. When metal is removed from mating surfaces without building up either of them, the gibs are adjusted to take up the slack.

After the ways have been mated, a complete check is made of the machine lubrication system, *Fig.* 8. Care is taken to insure that every oil port is open and the oil lines are clear. Where phenolic plastics have been used to build up a surface, the oil flow to that surface should be increased by replacing the meter with one of greater capacity.

After all mechanical parts and electrical components have been rebuilt or repaired, the major components, *Fig.* 9, of the machine are assembled as units, then joined in sequence to the machine. A basic and most important check when assembling a machine is that of the spindle position, *Fig.* 10, since all subsequent alignment checks are directly related to the spindle. Whenever possible, throughout the assembly of the machine, checks

Fig. 9. Checking spindle alignment. Since the spindle is the heart of any machine tool, it is carefully checked and everything aligned to it.

Fig. 10. A completely rebuilt mill receiving final inspection before being returned to production.

are made for smoothness of operation and bearing adjustment.

First check, after a machine has been completely assembled, is to run the machine at normal operating speed without load. If the machine performs properly, it is run through a series of speed and feed changes to determine if it is timed correctly and to make sure that all shifting mechanisms are functioning properly. Shop operational alignment tests, visual inspection, tolerance inspection and final rebuild inspection are accomplished before the machine is removed to the rebuild paint room. When a machine does not pass the various inspection tests, it is returned for disassembly and the necessary corrections are made. In the paint room, all nonbearing surfaces are filled, sanded, primed and painted with high gloss machinery enamel. Lettering is retouched in contrasting colors.

The machine is rechecked after painting, *Fig.* 11, and is then reinstalled by the millwrights on the production floor, leveled and tested before being turned over to the shop supervisor. Rebuild personnel check the machine and its operator after one full day of operating under a load. Small adjustments are made on the spot or the machine is "tagged-out" until adjustments can be made. Further tests and adjustments are made after the machine has been in operation for two weeks.

There is no way to prove, or even estimate accurately, the dollar savings that have been realized by this machine rebuilding program. The only measurable accomplishment is that, over a three-year period, a total of 322 machines were returned to production and tooling departments in first-class condition. Multiply this figure by the monetary value of new equipment and a satisfactory analysis of the accomplishments of this program can best be realized. Also, time advantages of the program are, properly speaking, identical with dollar savings since "time is money."

Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

Method of Machining Slots

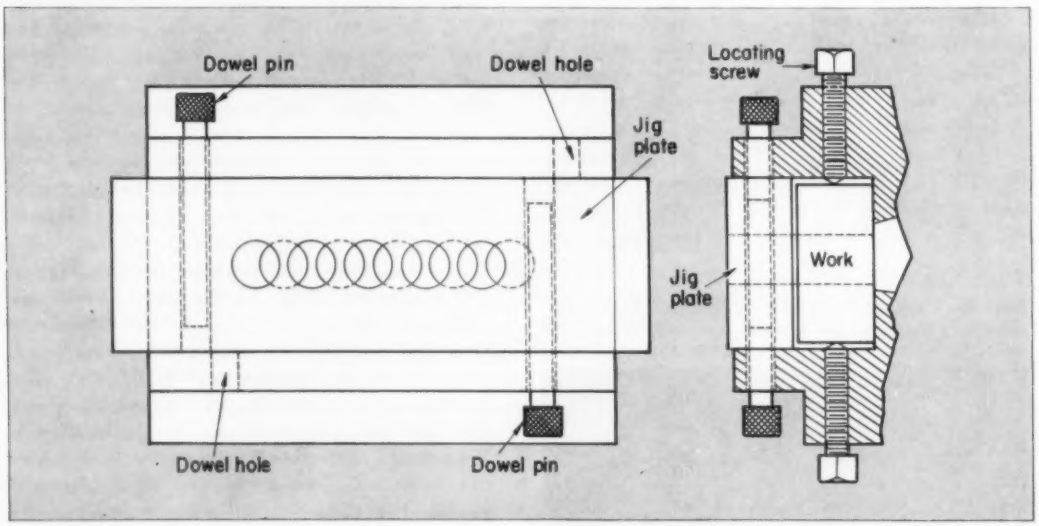
When machining a slot in work, a common method is to drill a row of closely spaced holes with a jig and break down walls between by some other means. An efficient method for doing the job, in which the walls are removed before taking the work from the jig, is illustrated in the sketch.

In this setup, a removable jig plate is held in line over the work by two walls of the jig frame, between which an unattached jig plate is free to slide endwise. The plate is held over the work in lengthwise position by two removable dowels. These pass horizontally through the walls of the jig and into the jig plate.

Through the sides of the jig are two sets of dowel holes which permit the jig plate to be set in two positions; one for drilling the holes and the other for drilling out the walls between. By shifting the dowel plugs from one set of holes to the other, the plate is moved endwise a half hole plus wall thickness. This brings the jig holes directly over the walls between drilled holes.

The walls between holes are then easily broken down by using a "fish tail" drill, with cutting edges ground inward away from the point, which makes a slightly conical cut when drilling. The jig guides the drill at the start but this form of drill tends to run straight because it is guided by the side walls of the cut as well as the slightly conical cut made by its cutting point. This method removes nearly all of the stock for broaching or other means of finishing the slot.

Frank E. Chace
Pawtucket, R. I.



Scroll Turning Fixture

From time to time, small numbers of scroll plates having a true spiral of accurate pitch have been required. The illustrated device was built to accomplish this kind of job and has given fine results.

Basically, the unit is a simple fixture mounted on the bed of an engine lathe. This fixture permits work to be held and turned at 90 deg to the axis of the head spindle of the lathe. With work held in this position, it is possible to utilize the carriage travel of the lathe, guided by the leadscrew, to produce spirals of any lead within the capacity of the leadscrew and change gearing.

The fixture is built as a weldment and is machined on its base to locate on one V and one flat

way of the lathe bed. Holes are line bored through the two upright members to accommodate a pair of plain bearings into which is fitted a solid spindle similar to a lathe head spindle. This spindle must be located on the exact center line of the lathe so that it may be driven by bevel gears from the lathe head spindle, as shown. This auxiliary spindle is provided with ball thrust bearings at both ends so that it may be preloaded axially by the adjusting nuts at the rear of the spindle. A chuck or faceplate may be attached to the spindle nose to hold the work.

The driving bevel gear is mounted on a simple tapered adapter which is held in the tapered socket of the head spindle. This tapered adapter should be drilled and tapped and provided with a draw-in bar which is run through the lathe spindle. This will usually be sufficient to provide a positive drive to the mechanism.

In cases where the usual change gears will not provide a desired lead, it is possible to alter the 1 to 1 ratio of driver and driven bevel gears. For instance, on a lathe which will cut a maximum lead of $\frac{1}{4}$ inch, it is possible to secure a 2 to 1 ratio on the bevel gears to cut a $\frac{1}{2}$ inch lead spiral.

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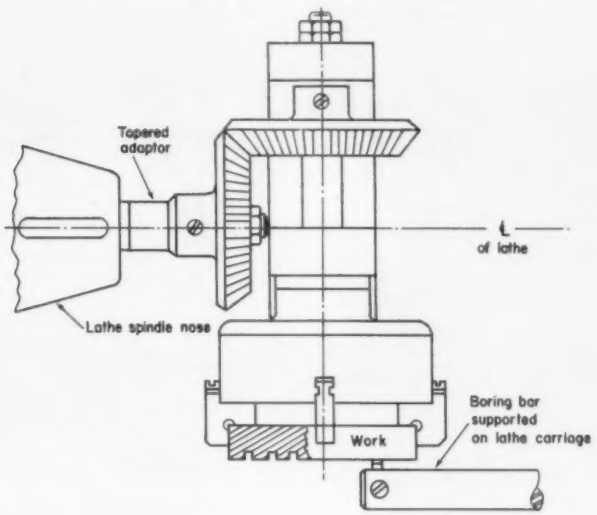
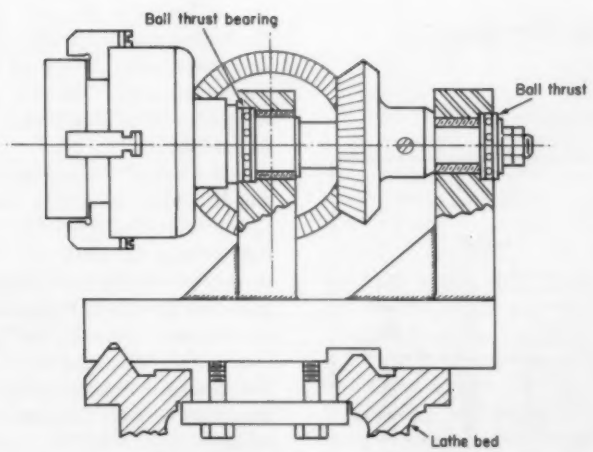


Top View



View from Tailstock of Lathe

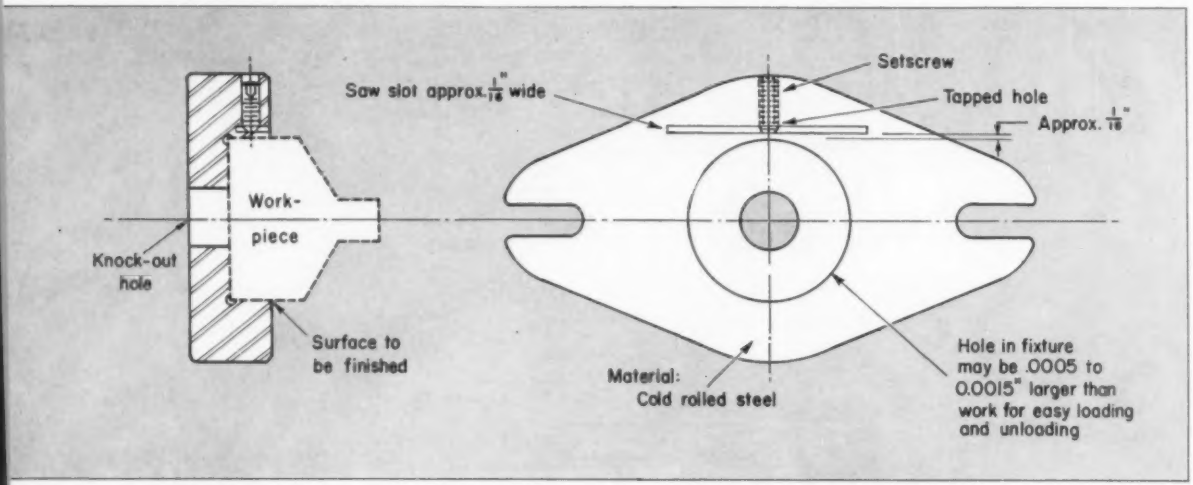
Gadgets

Improved Work Holding Method

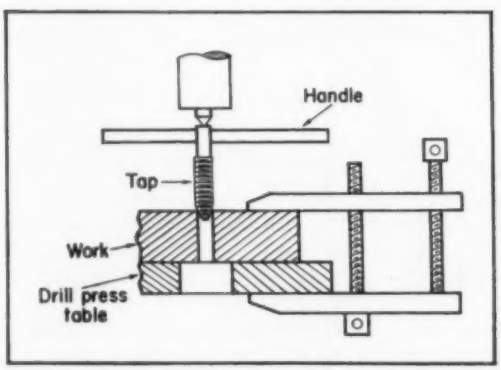
For some types of second operations, it is often desirable to hold a cylindrical workpiece in a fixture or adapter by means of a setscrew or similar arrangement. An improvement over the conventional method is shown in the accompanying sketch. A $\frac{1}{16}$-inch slot is milled about $\frac{1}{16}$ inch back of the workpiece recess. The hole for the setscrew is then drilled and threaded only as far as the slot.

With this arrangement the screw bears only on the fixture. There is sufficient elasticity in the fixture material to hold the work securely without directional forces throwing it out of position. Also, marking or marring the workpiece is avoided without the necessity of using a brass plug. The arrangement is good for any number of pieces by using a setscrew with a smooth end.

Daniel J. Forward
Rochester, N. Y.



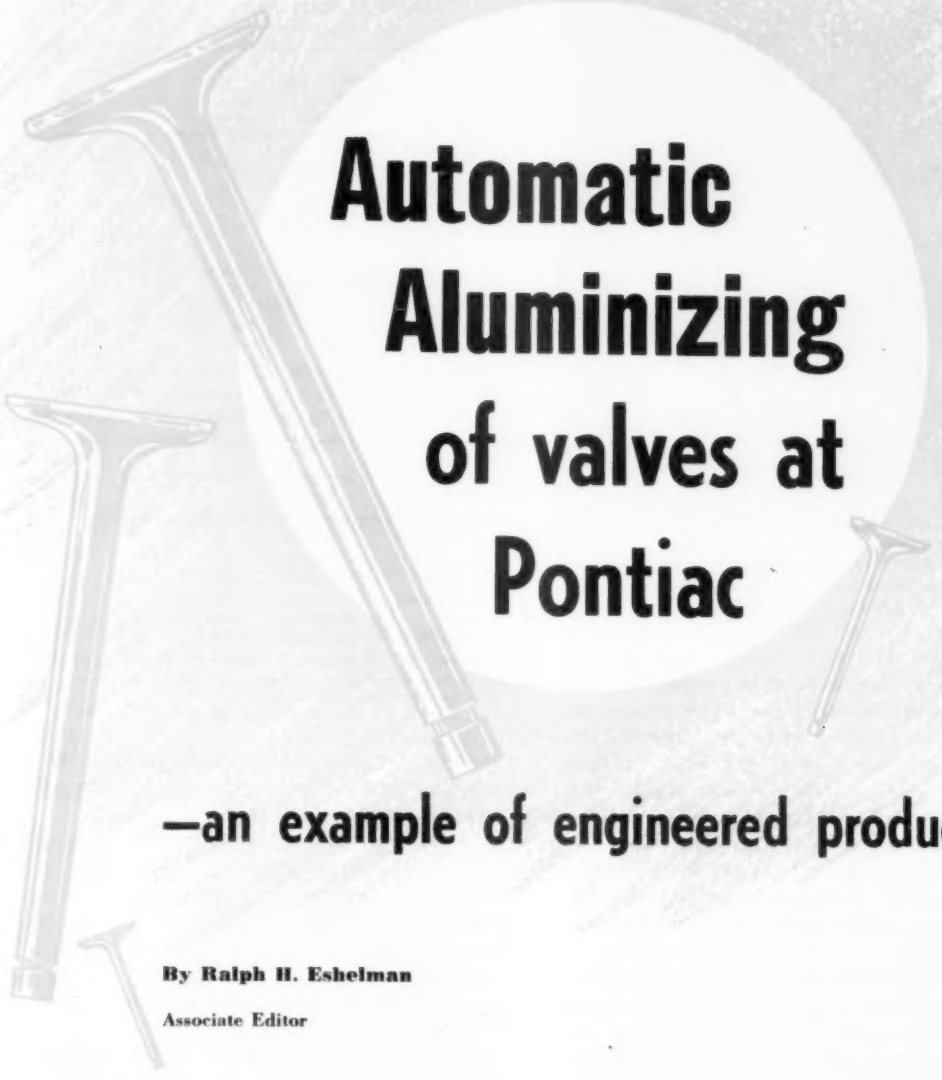
Aligning Holes for Tapping



Drilled holes can readily be tapped by hand with precision by using this simple method. First the workpiece is clamped on a drill press so that the centerpunch mark aligns with the center of the drill press axis. The hole is then drilled to the correct diameter. The drill chuck is removed and replaced with a lathe center. A live center is best for the purpose.

The point of the tap is placed in the hole and the drill press spindle is lowered until the center lightly enters the tapered hole in the tap head. The hole is then threaded by turning the tap with a driver, which has previously been placed on the tool. For the first half dozen threads, the drill press spindle must follow the tap in such a way that the center never leaves the tapered hole in the tap head. The pressure exerted however, should be slight. Operation of the drill press feed is best done by a helper.

Federico Strasser
Santiago de Chile



Automatic Aluminizing of valves at Pontiac

—an example of engineered production

By Ralph H. Eshelman

Associate Editor

RARELY IS as clear-cut an example of engineered production encountered as that afforded by the valve aluminizing installation at the Pontiac Motor Div. of General Motors Corp. The process is the result of a logical development throughout. First, a determination was made by design engineering that aluminizing of intake and exhaust valves was highly desirable for product quality and performance. Next, a process was developed for production, based on results of laboratory research.

After an adequate period of trial and adjustment, this method had to be abandoned as unsuited to high-production conditions. In light of production experience, the problem was submitted to an engineering study. A detailed report was prepared from this study, outlining principles and requirements of a production process for aluminizing. Finally, machine suppliers with experience in similar fields were consulted. Equipment was designed to meet specifications developed. The result is a highly successful installation, *Fig.* 1, which achieves the necessary output, can be carefully controlled within the desired limits and readily meets quality requirements.

Although advantages of coating iron and steel with aluminum for resistance to heat oxidation and atmospheric corrosion have been known for many years, little use has been made of the process in the automotive field. Recent automotive design trends, however, have necessitated improvement in valve

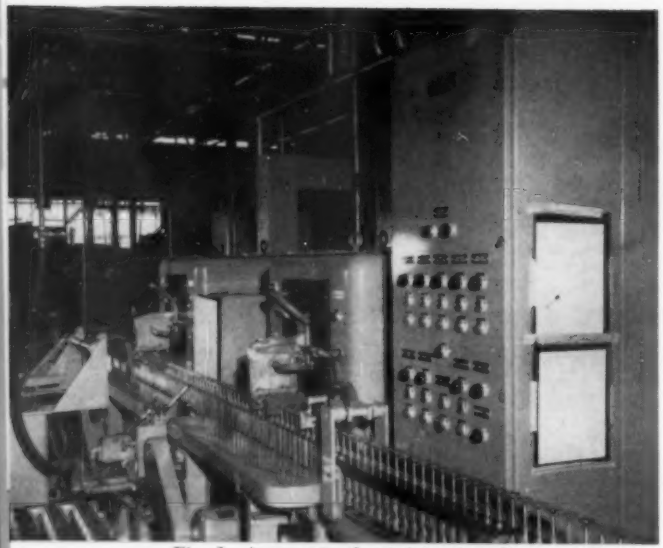


Fig. 1. Automatic aluminizing installation at Pontiac Motor Div., GMC. Intial induction heating is in foreground, metallizing gun can be seen in center and final induction heating is in background.

materials. The trends referred to are increased engine temperatures and higher valve stresses, the result of higher performance requirements. One solution has been the use of high-alloy steels for valves and carbide inserts for valve seats in order to increase durability. Aluminizing, however, offers several advantages. The desired performance can be secured without going to higher cost and more limited materials. Potentially at least, aluminizing offers lower production costs and simpler manufacturing methods.

When Pontiac engineers decided to utilize aluminizing for increasing valve life, they had the benefit of investigations already performed by the Research Laboratories Div. of GMC, tests that began in 1948. Several processes for applying aluminum coatings to steel were available, such as electroplating, hot-dipping, chemical reaction, cladding, Calorizing and spraying. Some of these methods have been utilized commercially and results obtained with them are compared in TABLE 1.

Table 1. Comparison of Processes for Aluminum Coating Steel*

Process	Thickness of Coating (mils)	Absence of Interfacial Layer	Continuity of Alum. Coating	Cost Rating
Hot Dipping	0.5- 3.0	2	2	1
Cladding	0.4- 5.0	3	1	2
Electroplating	0.1- 2.0	1	3	3
Chemical Reaction	0.5- 1.0	1	—	3
Calorizing†	10.0-40.0	4	—	3
Spraying	2.0-20.0	1	4	4

*Rating of 1 indicates best classification.
†Coatings heat treated for impregnation.

Table 2. Comparison of High Temperature Resistance of Various Coated and Uncoated Steels in Presence of Sulphur-Bearing Gases

Composition of Steel	Condition of Samples	Temp. (F)	Time (Hr)	Weight-Change* (%)
18-8 Cr-Ni Steel	Untreated	1350	24	—17.0
25-20 Cr-Ni Steel	Untreated	1350	4	— 8.3
27% Cr Steel	Untreated	1350	24	— 8.4
18-8 Cr-Ni Steel	Aluminized	1350	192	+ 0.1
Mild Steel	Aluminized	1350	192	+ 0.1
18-8 Cr-Ni Steel	Aluminized	1700	48	+ 0.0
Mild Steel	Aluminized	1700	48	+ 0.3

*After corrosion scale was removed.

A variety of processes are possible because an iron-aluminum alloy layer is formed almost instantaneously on contact of aluminum to ferrous metal at a temperature of above 900 F. The layer has a hardness over R_c60 and is brittle. Theoretically, it is comprised of several phases of aluminum and iron, depending on the aluminum concentration, but basically it is $FeAl_3$.

A hot-dip process developed by the Research Laboratories under the name of Aldip appeared to be the most economical and practical method. Valves coated with the experimental process im-

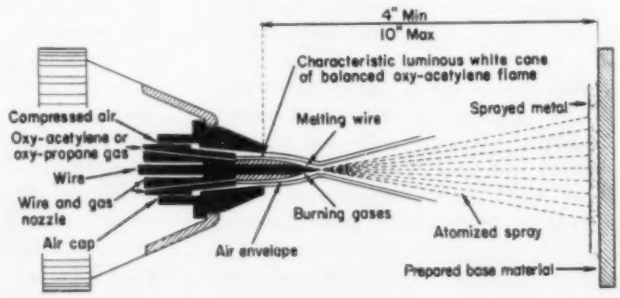
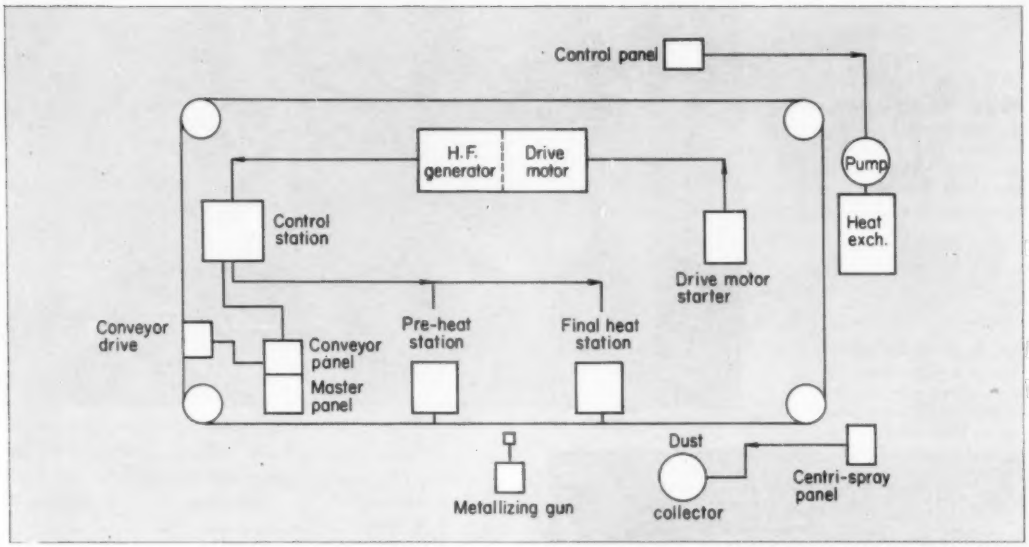


Fig. 2. Wire nozzle and air gap cross-section of Metco metallizing gun.



—*Sketch courtesy Lindberg Engineering Co.*

Fig. 3. Schematic diagram of valve aluminizing installation.

proved over 100 percent. Aluminized mild steel is reported equal or superior in heat resistance to nickel-chrome alloy steels, TABLE 2.

Essentially, the process consists of dipping the heads of previously cleaned valves in a molten salt bath for preheating and fluxing, then into a molten aluminum bath for a short period. Excess aluminum on the valve head is removed by means of an air blast. Molten aluminum adheres to the valve, alloying with the iron of the surface and forming a hard, heat-resistant alloy, 0.0005 to 0.0010 inch in depth. It is this alloy which gives the desired properties; excess aluminum on the surface is of little value. In fact, excess aluminum is undesirable in this application because of unevenness. Also, because of surface tension, it was difficult to remove.

Serious production difficulties were immediately experienced with the new process. Mechanical problems caused excessive down time. Then there was the problem of removal of excess aluminum from the coated part. In addition, it was found that some of the processed valves were only partly coated or not at all.

At this point, the engineering study was initiated to resolve these production problems. Conclusion reached was that the dip process was poorly suited to this particular application. Since the valve seat had to be held to 0.002 inch total indicator runout (TIR), a hand operation was needed to remove excess aluminum. Other inherent disadvantages were discovered in the method. Shape of the valve head caused difficulty in penetrating the aluminum bath because of surface tension. It was necessary to hold the salt bath level uniform to control valve stem runout. Also, the salt had to be sludged and agitated daily to insure proper fluxing properties. Loss of aluminum due to spillage and contamination raised aluminum consumption abnormally high.

The hot-dipping method was discontinued in production and engineering investigations were directed to the development of other methods. Metal spraying, as experimentally performed in research laboratories was considered for its adaptability to production requirements. The setup utilized a Metco type metallizing gun, *Fig.* 2, mounted on the tool post of an engine lathe. The valve was revolved in a three-jaw chuck. Preheating was performed by oxy-acetylene welding torch. Valves were precleaned by shot blasting with No. 41 steel shot and then processing in trichlorethylene degreaser. Variables which might affect the process were carefully investigated, including surface finish and thickness of the coating. This was found to be affected by spraying time, wire feed in the gun, valve rotating speed and spraying distance.

Since spraying with aluminum in itself is insufficient to form the iron-aluminum compound at the surface interface, heat treatment is necessary to obtain the heat-resistant layer by diffusion. Several methods were investigated, including immersion in salt bath, heating in a gas or electric heat treating furnace and heating by induction.

Induction heating appeared to offer excellent production possibilities because of low cycle time. Some difficulties were encountered with this method experimentally, particularly with the applied flux. Then it was discovered that by heating a sprayed valve without fluxing, the outside appearance of the coat remained unchanged but the

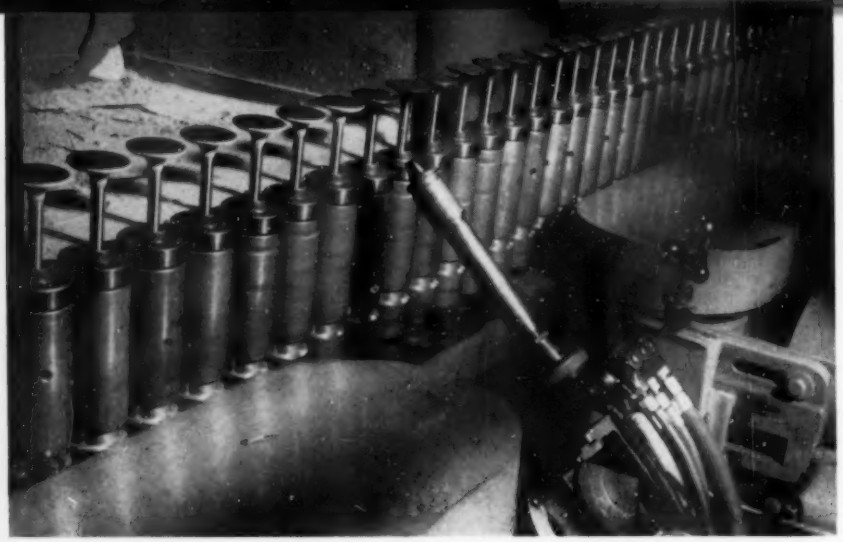
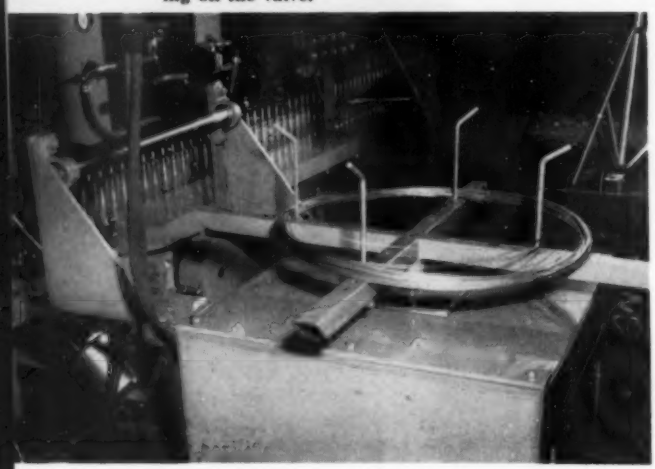


Fig. 4. Close-up view of spraying operation showing gun cone feed and work holding spindles. Valves at left have been aluminized.

Fig. 5. Coil aluminum wire is fed through the metallizing gun to provide the aluminum coating on the valve.



desired brittle iron-aluminum interface was still obtained.

Since valve stem runout was a major obstacle in the dipping process, this problem merited special consideration in the development of a new coating process. Tests made with the spraying techniques indicated that runout as a result of this process could be controlled within reasonable limits. Increase in runout was found to be almost directly proportional to the amount of aluminum sprayed on the surface. Eventually, it was found that satisfactory coatings could be obtained with this method of heating even without the use of a flux.

As a result of the experimental process development, definite recommendations were made regarding the type of installation needed to meet production requirements. The thoroughness of the study is indicated by the fact that the final installation, designed and built by Lindberg Engineering Co., shown schematically in *Fig.* 3, incorporates virtually all recommendations. Briefly the major components in the installation are as follows:

1. A motor generator as source of high-frequency power.
2. A motor starter for controlling the motor generator drive motor.
3. A control station for regulating and controlling application of high-frequency power.
4. Two heating stations to apply high-frequency power to the inductors and heat the valves.
5. Conveyor system and control panels for controlling the operation of the work handling equipment.
6. Heat exchanger, water circulating system and associated controls.
7. Dust collector, sludge conveyor and centri-spray panel.
8. Metallizing gun of oxy-acetylene type for spraying operation.

The operation is automatic, requiring only manual loading and unloading. It is designed for a production rate of 2000 pieces per hour. The metallizing gun, fed automatically, sprays aluminum on the preheated valves while they are rotated past it. Next the valves pass through a diffusion heat treatment to form the aluminum-iron coating. This is simply performed by induction coils which heat the valves to the proper temperature.

Function of the conveyor system is to move the valves past or through the various operations. A spindle type work-holding fixture is supplied for each valve, as illustrated in *Fig.* 4. These spindles rotate the valves at approximately 100 to 150 rpm past the metallizing operation and somewhat slower when passing the preheat and final induction heating coils. Rotation is supplied by belt drives at each one of these stations. This insures uniformity in heating, application of the coating and diffusion afterwards.

The generator's power is fed to the heating stations through a main contactor. In each of the heating stations, a variable-ratio transformer reduces the generator voltage from approximately 800 v to approximately 40-80 v and applies this voltage to the single-turn inductor through which the valves pass to be heated. This transformer is of special design and completely water cooled to handle the large, high-frequency currents required.

In each heating station there are capacitors to correct the power factor of the load, which is inherently low for all induction heating loads.

These capacitors are also water cooled and, along with the transformer, are adequately protected against insufficient cooling by preset water flow switches that will remove the power under subnormal flow. High-frequency current flowing into the inductor coils is several thousand amps and induces in the valve heads, as they pass, a similar current which raises their temperature to the degree necessary for proper aluminizing of the valve face.

Other electrical equipment consists of control panels to house the various relays, motor starters and protective devices required to operate the conveyor lines, heat exchanger and dust collector. The entire electrical system is interlocked and so connected as to provide flexibility, safety and product uniformity.

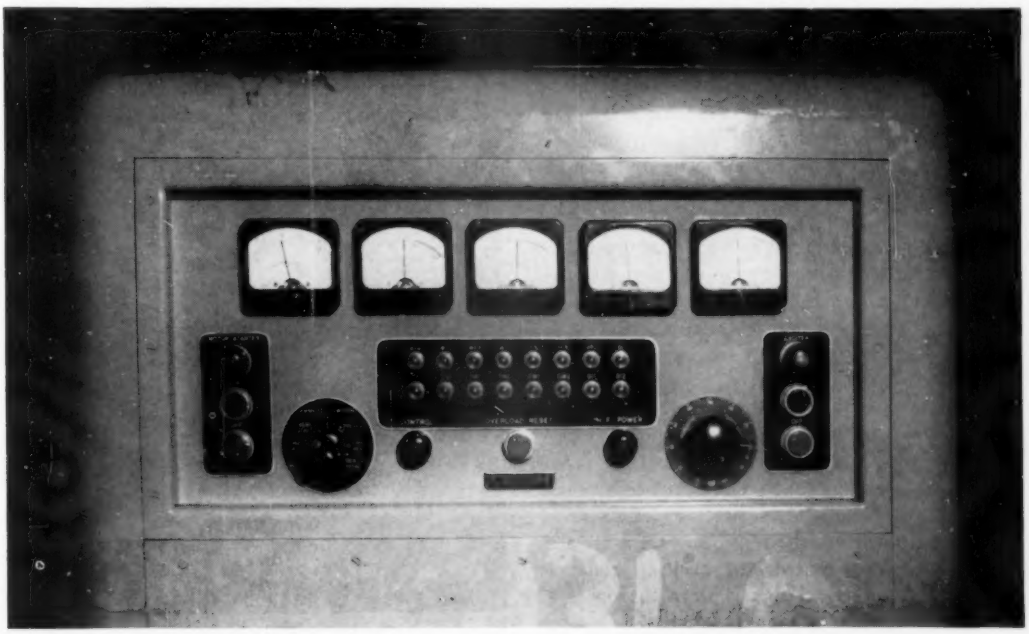
The metallizing gun takes aluminum wire fed from the reel, *Fig.* 5, over the roller on a metallizing cabinet, under the roller on the metallizing gun stand, up through the gun and into the nozzle. Best results have been secured with 15-gage, 2-S wire. A starter button on the conveyor panel energizes the gun starter and starts the drive cone on the gun revolving. Metal will not feed through, however, until the spring-loaded idler roller is tightened down against the aluminum wire. Attached to the idler assembly is a small rubber-rimmed wheel which is driven by the idler and is connected to a zero speed switch by means of a flexible shaft.

As the metal feeds through the gun, the idler drives a zero speed switch whose contacts close the energized relay in the master panel. If metal stops feeding through the gun, the idler will stop and the switch open, stopping the conveyor to prevent unsprayed valves from coming off the line. Pressures of the oxy-acetylene and air through the gun are regulated by controls on the gun to insure the correct flame for spraying. Presence of a properly regulated flame is sensed by a flame-detector cell and amplified. The signal energizes a relay in the master panel. If the flame goes out, the relay in the panel drops out and the conveyor travel stops, preventing unsprayed valves from going through.

The fan of the dust collector which removes excess aluminum from the air, has backward-inclined blades and a nonoverloading power characteristic. As fan and sludge conveyor are started, relays are energized permitting operation of the metallizing gun. No metal, however, can be sprayed without the collector and sludge conveyor operating. This control is provided by interlocks and assures safety of operation.

Temperature of the preheat induction coil is 400 to 500 F and of the diffusion coil or second heat treating operation is 1400 to 1500 F. At the start of the operation, one or more valves are checked by appearance and weight to determine that the correct deposit is being made. This is between 0.05 and 0.1 gram. Adjustments in the metallizing

Fig. 6. Main control panel of installation contains many interlocks and protective devices.



gun angle or spacing or the metal feed rate provide sufficient control for normal variables. The deposit of aluminum does not materially change the size of the valve seat nor require any subsequent finishing. If the valve is within the correct runout tolerance (0.002 inch TIR) following the grinding operation that precedes the aluminizing, it will normally be well within the same tolerance after the aluminizing operation.

As indicated in the description of the installation, numerous protective devices are provided to control the operation and prevent damage to parts and equipment. Principal controls are located on the control section front panel, *Fig.* 6, and the rear access door is mechanically latched to the main circuit breaker. Thus, all equipment is shut down when the door is opened. To assure proper alignment of the valves in the workholding fixtures, a rubber-tired positioning wheel, *Fig.* 1, bottoms each valve before it reaches the preheat station. Should a valve be out of position, however, a deflecting switch gate at the first station will shut down the conveyor.

When the equipment is started on a production run, it will operate continuously unless one of the following conditions intervenes:

1. The master cycle stop button is pressed.
2. The high-frequency generator stop button is pressed.
3. The conveyor drive stops.
4. The metal feed stops.
5. A valve is misaligned at entry into the preheat coil.
6. The flame on the metallizing gun goes out.
7. A void of more than two valves in the spindle line occurs.
8. The dust collector fan at the gun goes off.
9. Emergency stop at the unload station is pressed.
10. Any of the generator protective devices operate because of excessive water temperature, excessive air temperature, inadequate water flow, overload in the field circuit, overload in the high-frequency circuit, overload of the drive motor.
11. Any of the control station or heating station protective devices operate, indicating insufficient transformer water flow, insufficient capacitor water flow, excessive water temperature, open door interlock, high frequency ground.

Any of the above conditions will stop the conveyor completely and turn off the high-frequency power to the work coils. The water cooling provided for the induction coil transformer, the capacitor and motor-generator units is thus controlled automatically.

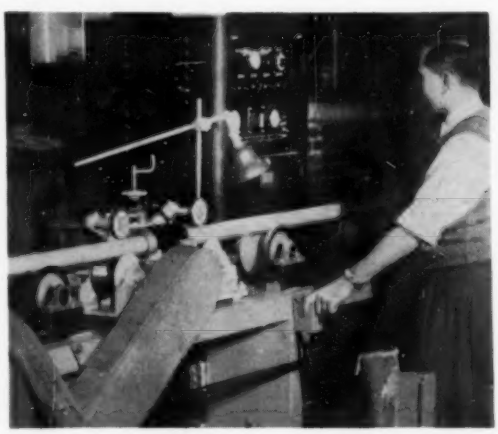
This case history of successful process development illustrates several cardinal points of tool engineering. For one thing, it exemplifies how a stubborn production problem will yield to the engineering approach with the application of hard work and logic. Second, it demonstrates how successful results can be achieved when the special abilities of tool engineers and machine designers are joined. And finally, it indicates that engineering for production is basically grounded in common sense and careful attention to detail.

Acknowledgement: Special recognition is due Pontiac Motor Div., GMC, particularly the Metallurgical Department, and also Lindberg Engineering Co. for their assistance in supplying illustrations and information for this article.

Nondestructive Testing For Continuous Quality Control

Advances in nondestructive inspection are assured with an electrical testing instrument for detection of variation in chemistry, wall thickness, outside or inside diameter of pipe or tube. The equipment, outgrowth of two years joint experiment and research by The Carpenter Steel Co. and Magnetic Analysis Corp., has been put to work commercially at Carpenter's Alloy Tube Div. As it is now set up, it is capable of inspection tubing with OD's ranging from ¼ to 3¼ in., although research is continuing to expand the size range and the extent of wall penetration in thicker tubing.

The method is designed to reveal minute defects invisible to the eye, as well as those that cannot be detected by hydrostatic test. Such flaws as carburization on the ID of a tube, weepers, mechanical defects from mishandling, notches, gouges on the inner surface or imperfections in the parent metal can all be picked out by the instrument at production speeds. Audio-visual signals warn the operator the instant a defect passes through the testing coil. Test results also are continuously visible on an oscilloscope as a tube passes through the detector device.



Machining Germanium to conserve material

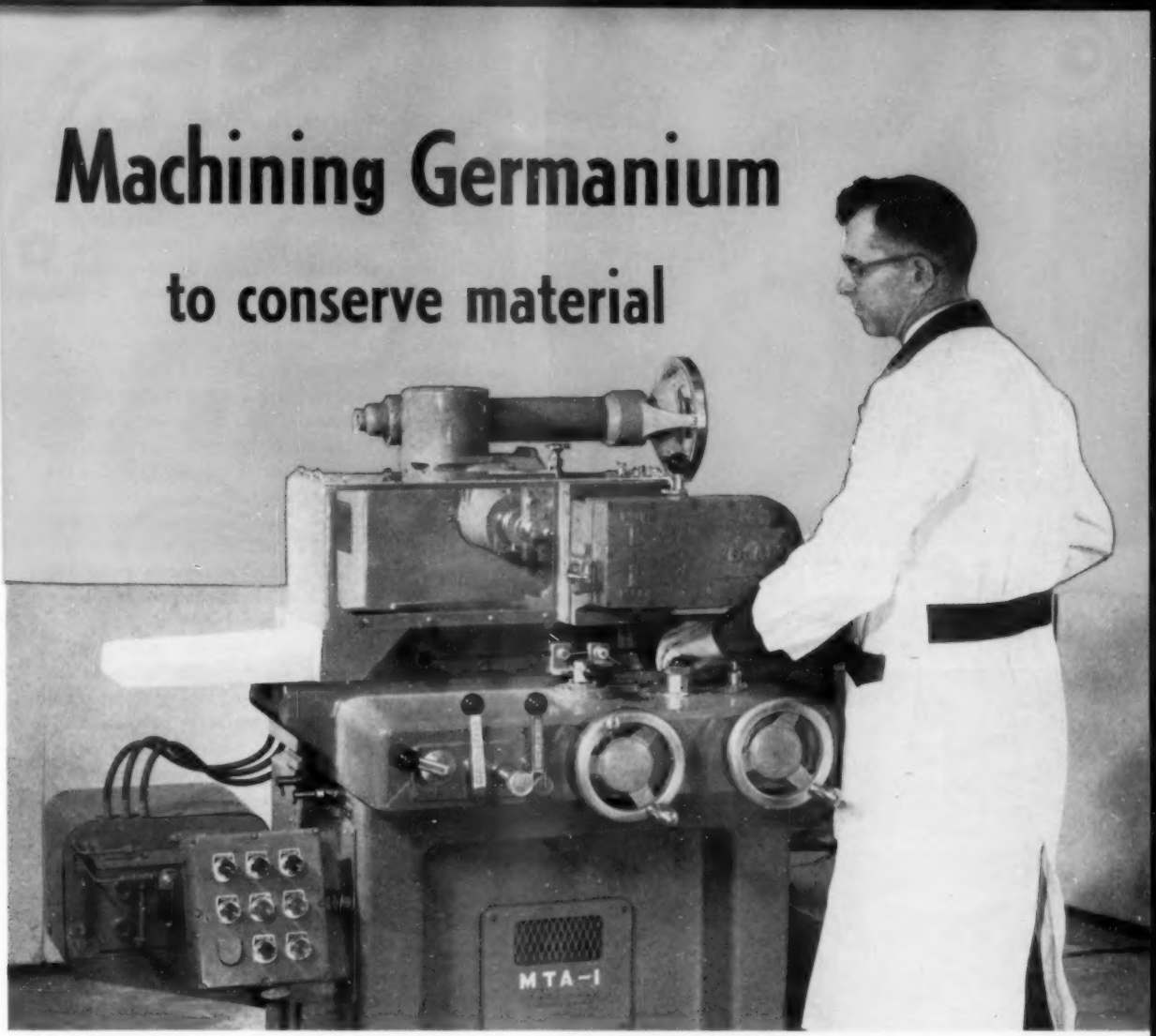


Fig. 1. Precision slicing machine equipped with motorized slicing fixture. Operator is adjusting table feed.

By Robert L. Crane
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Des Plaines, Ill.

When operations move out of the research laboratory into the plant, improved techniques, tooling and equipment are often required. Typical of many new problems confronting the tool engineer as a result of materials developments are those involved in machining germanium. Some worthwhile answers will be found in the following article.

DEVELOPMENT OF TRANSISTOR manufacture from a laboratory to a production process has posed some interesting problems. One of the foremost is how to cut germanium or silicon crystals into the tiny but dimensionally accurate pieces that form the working parts of transistors—tiny components that obviate vacuum tubes in electronic instruments. The raw material is in the form of a single crystal, generally a bar 4 to 5 inches in length and up to 1½ inches in diameter. Often, its shape is more triangular than cylindrical. Germanium is hard, extremely brittle and expensive—selling at about $400 per pound. For most transistors it must be sliced into thin wafers 0.010 to 0.015 inch in thickness. Where power transistors are the end product, the entire wafer may be used but usually it is cut or "diced" into squares as small as 0.050 inch on a

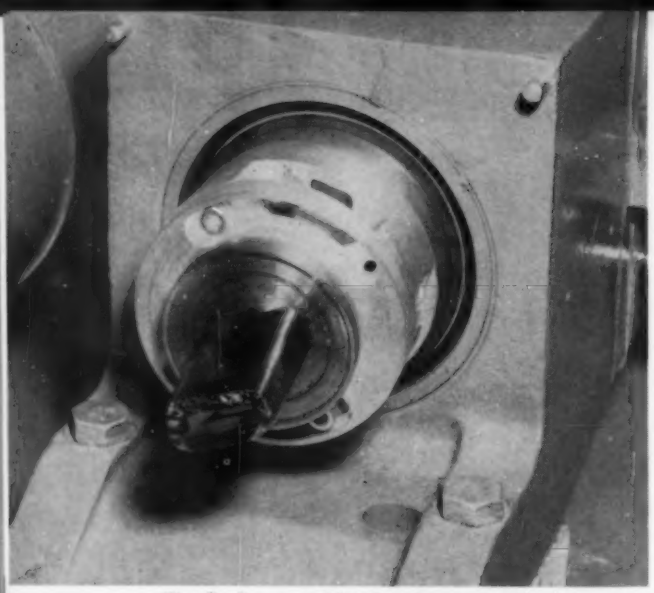


Fig. 2. Compound headstock permits aligning proper crystallographic plane to cutting plane of saw. Germanium crystal is cemented to headstock and aligned in proper plane.

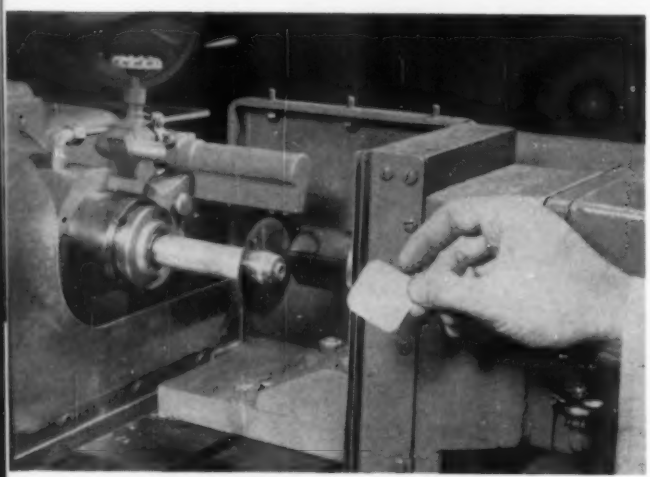


Fig. 3. Close-up of worktable with guards removed and slicing fixture in place. Workpiece is rotated so that small circular saws can be used to cut more wafers from each germanium crystal.

side, after which it is lapped and etched to its final thickness.

To achieve desired electrical characteristics in the finished transistor, the crystal must be sliced parallel to a specific crystallographic plane. An X-ray examination of the crystal determines this plane which is not always at right angles to the longitudinal axis of the crystal bar. In conventional practice, the crystal is cemented to a workholding plate and set up on a worktable in proper relation to the cutting plane of a circular saw blade large enough to cut through the cross section of the crystal. In slicing 1½-inch diam crystals by this method, the thinnest practical circular diamond saw cuts a kerf 0.030 inch. Thus, in producing 0.015 or 0.020-inch wafers, more material is reduced to dust than to usable wafers.

Slicing: This waste may be minimized by using smaller, thinner saws and a slicing fixture designed for use on a new precision slicing machine, *Fig.* 1. This gives a substantial increase in the number of usable transistor blanks secured from each crystal. Essentially, the device is a motorized precision headstock that can be mounted on the worktable and accurately aligned parallel to the cutting spindle. The face plate to which the end of a germanium crystal can be cemented is a compound assembly, adjustable to bring the crystallographic plane into coincidence with the plane of rotation, *Fig.* 2. The crystal can then be rotated at an appropriate speed during the cutting stroke. Thus, a saw only large enough to cut to the center of the workpiece will suffice as shown in *Fig.* 3. For crystals under 1½ inches in diameter, a 3-inch saw may be satisfactory. Such a circular blade reduces only 0.015 inch of material to dust.

Transparent plastic splash guards fit the fixture and table end plate, enclosing the work area but permitting visibility. Set up for precision, automatic slicing is not difficult. Adjustable keys on the fixture base provide for quick, accurate alignment of fixture to spindle. Once the work has been mounted and positioned the cutting stroke can be set with movable trip dogs on the front of the table. A screw stop permits fine adjustment of cross-index increments.

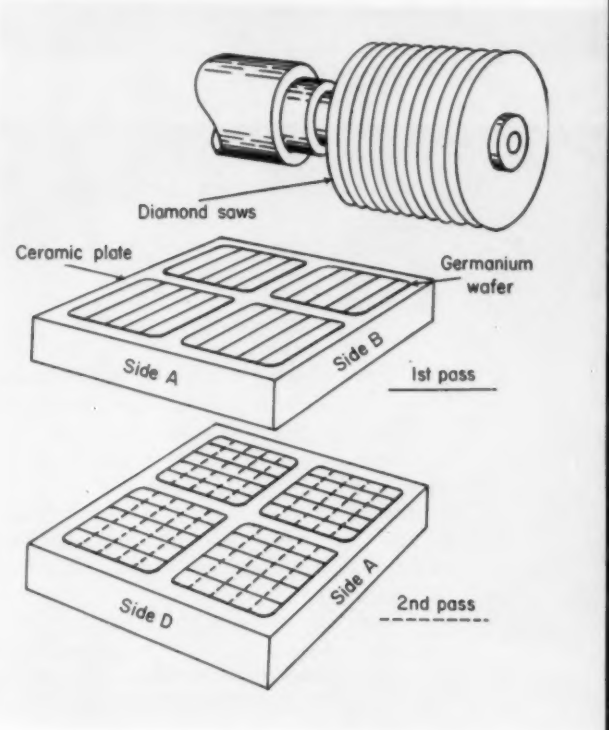
Cutting feeds can be set to less than one inch per minute. At such slow speeds, tables may have a tendency to bind and move erratically. This is overcome through the use of a special flow-control valve for the table drive. The "bleed-off" method used in DoAll's standard slow drive provides steady positive travel under load. Furthermore, the lubrication system for the table and saddle ways is independent of the hydraulic drive system, permitting the use of high surface tension oil which resists "squeezing out" at these low table speeds. Flow rate of lubricant to the ways is maintained automatically and accurately.

The cross index will repeat to plus or minus 0.0025 inch. After preliminary setup, feed and index hydraulic cylinders can be relieved of any traces of trapped air by momentarily opening bleeder valves. This will insure a smooth cutting stroke and accurate index from the first cut. Once started, the slicing cycle will continue automatically until the entire crystal has been cut into wafers.

Dicing: Most transistor blanks are made by cutting the thin wafers into tiny squares. The wafers are held for dicing by cementing them to ceramic plates which are held by a fixture on the worktable of the slicing machine. The fixture is a

Fig. 4. (left) Machine arranged for dicing germanium wafers. Spindle shaft extension carries twelve diamond saws. The wafers are cemented to ceramic plates.

Fig. 5. (below) Diagram illustrating the procedure by which blanks are diced. First pass cuts strips. Plates are then turned for second pass, dicing the wafers to desired size.



serrated chuck with backstop and clamps to hold five plates 4½ inches square, *Fig.* 4. Each plate can be covered with germanium or silicon wafers so that a full work load might be 20 or more wafers. The spindle is a special high-speed unit with a 3½-inch extension to permit mounting several 3-inch circular diamond saw blades, appropriately spaced. A typical setup might involve 12 blades spaced 0.250 inch apart so that the entire working area of the fixture is covered at a single pass. Slow table feed is used and the depth of cut is set to cut through the wafers in one stroke. If wheel spacing corresponds to the desired blank size the blades are turned 90 deg and the work load finished in a second pass, *Fig.* 5. If the very small blanks are required, it may be desirable to space the blades twice or three times the single blank width because, when very small blanks are diced, the adhesive area may be reduced to a point where the force of cutting both edges tends to tear the blanks away from the ceramic mounting plate. When using wider blades, the blanks are cut on one side, then cross indexed for a cut along the other side.

When set up for dicing, the worktable is enclosed by cast-iron end guards, a sheet steel top, flexible curtain at the rear and a removable, transparent plastic panel at the front. A work light, incorporated in the right end guard, illuminates the work area. A coolant spout distributes coolant to all the cutting blades.

Design Features: Machine base is heavy, stabilized, nickel cast iron. The saddle and table are pressure lubricated with hand-scraped ways. An integrated hydraulic system provides smooth cutting feeds with a quick return. An accurate cross index makes the slicing operation completely automatic. The precision, high-speed, antifriction bearing spindle is belt driven by a 1½-hp motor. The spindle is pressure mist lubricated and mounted on a long cast column scraped to a precision fit in the base column ways. Table and saddle are provided with coolant troughs to carry coolant and grinding dust back to the reservoir which is equipped with an ultrafine paper filter to purify the coolant and salvage valuable metallic dust.

A convenient control panel includes magnetic starters for spindle motor, hydraulic motor, coolant motor and slicing fixture. Heavy-duty outlets for coolant and fixture motors are recessed in the panel. Oil-tight pushbuttons for controlling all motors are conveniently located in a gasketed cast enclosure at the front.

Other Uses: Piezoelectric crystalline material is easily cut on this precision machine. Also, many industrial materials unrelated to transistors or electronics can be effectively cut on the slicing machine. It is suitable for slicing test blanks from hardened steel or tungsten carbides. Its extremely slow and smooth feed, coupled with a vibrationless spindle, makes it capable of precision slicing of a wide range of hard-to-machine materials.

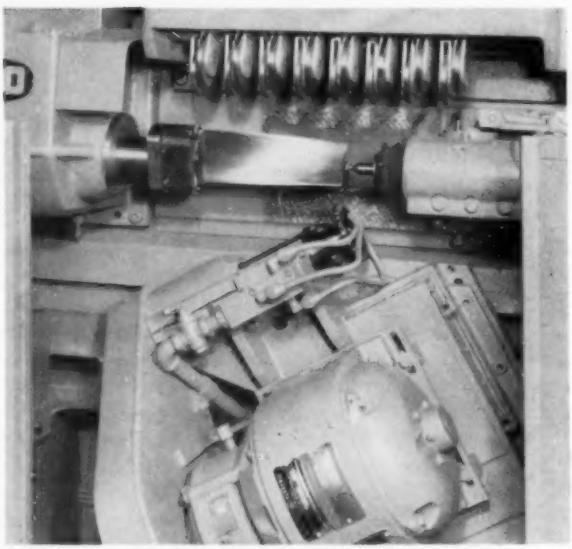
designed for

PRODUCTION

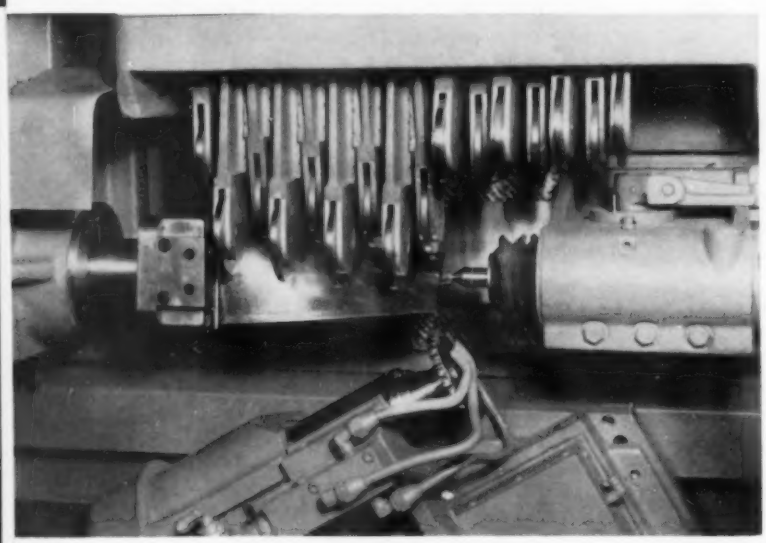
Steadyrests Resist Pressure Without Applying Any

Roller type steadyrests that conform to irregular contours are a design feature of profile millers manufactured by Ex-Cell-O Corp., Detroit, Mich. In an automatic cycle, these machines mill the entire airfoil contour of compressor and turbine blades for jet aircraft engines. Steadyrests back up the thin parts rigidly to permit heavy milling cuts, yet they exert no pressure on the work. They simply resist cutting pressure.

The machine is equipped with a sufficient number of fingers to support the longest workpiece that can be accommodated by the machine. When the machine is used for shorter workpieces, surplus fingers are retained in the up position where they are out of the way.



ROLLER TYPE STEADYRESTS are raised by a hand lever for loading blanks and unloading blades. Unneeded fingers are restrained from descending when the following workpiece is loaded. When rollers are in contact with the blank, the "start" button is pushed and the rests are hydraulically clamped in position.

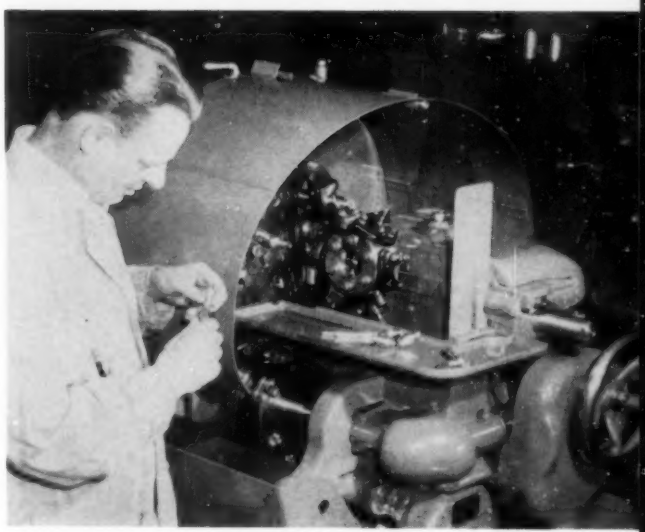


ALTERNATE FINGERS are staggered to help resist side pressure on the work. Hydraulic pressure is applied to the fingers horizontally so they can resist cutting pressure without exerting any downward force on the blade. After each longitudinal cutting stroke, hydraulic pressure is released, the blade is indexed radially while the rollers contact it and clamping pressure is reapplied, all automatically.

Plastic High-Speed Reversing Clutch Increases Screw Machine Productivity

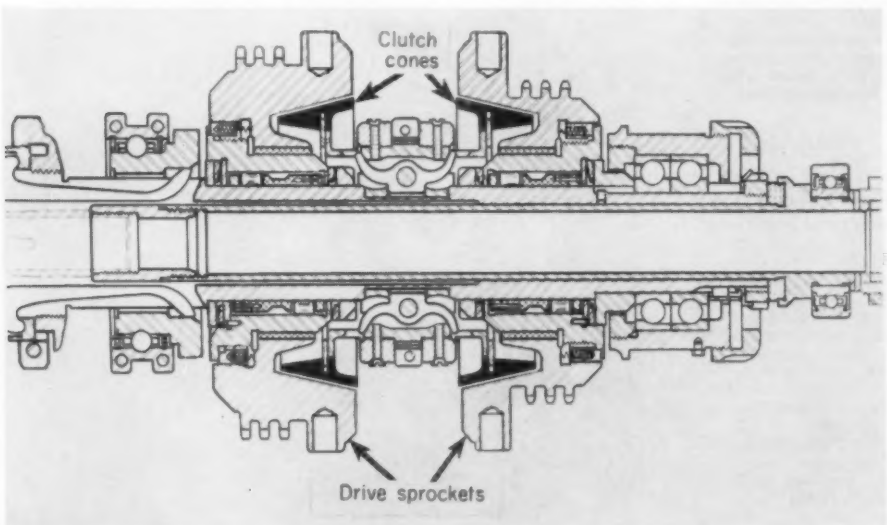
Time lost in reversing movements is a limiting factor in the productive capacity of high-speed automatic machine tools. The Brown & Sharpe Mfg. Co., avoids lost time in a high-speed automatic screw machine by using a reversing clutch of unusual design. Contributing to the success of the clutch is a movable plastic cone that meets the requirements for high-speed operation. The cone is strong, has low inertia and resists the heat generated by rapid engagement and disengagement.

Clutch cones are made by Synthane Corp., Oaks, Pa. Square woven cotton fabric is impregnated with phenolic resin, macerated into small flakes and molded under high pressure and heat. Weight of the cone is reduced because it can be bonded to the steel member that moves it into and out of engagement.

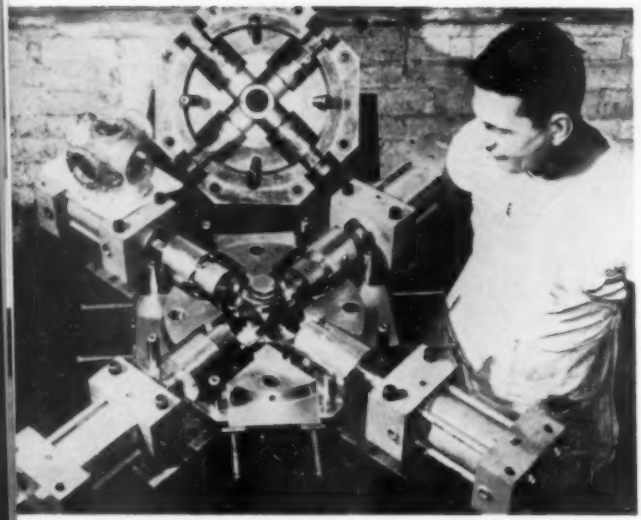


HIGH PRODUCTION is achieved with this automatic screw machine because both machining and tool positioning are accomplished rapidly. Fast action is achieved through a spindle drive reversing clutch.

SPINDLE DRIVE reversing clutch includes two macerated molded phenolic cones. Clutch cones are bonded to supporting steel disks during molding. Clutch surface grips smoothly, is long wearing and resists heat-induced warping.



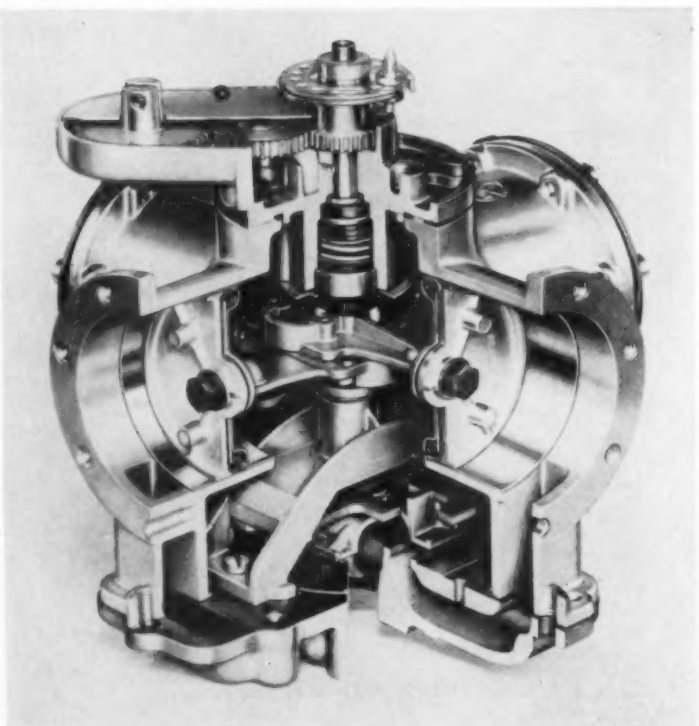
Eight Moving Cores Die Cast Complex Housing



FOUR CYLINDRICAL cores, actuated by hydraulic cylinders, and four cores that form the sides of a gasoline meter housing can be withdrawn to release the die-cast part. Six major openings are formed by the moving and fixed cores. Holes for mounting components and securing covers are also cored. Boring of the cylinder holes, some finishing of the base and tapping of attachment holes are the only machining steps required.

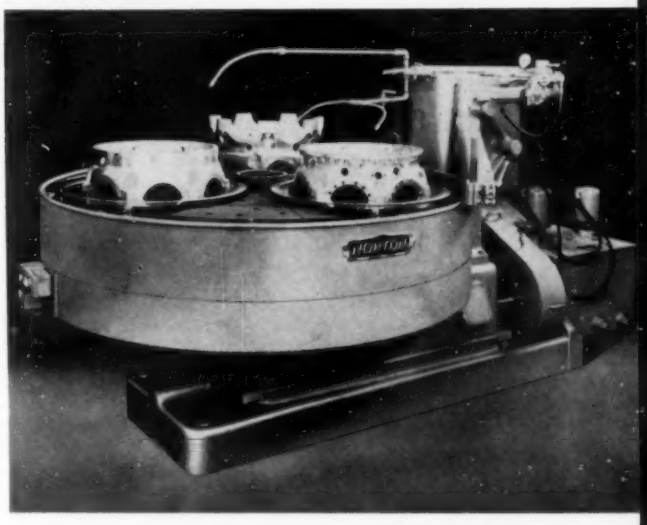
Unusual tooling produces a one-piece aluminum housing for a gasoline meter. Six major openings are required in the housing. Die casting was selected as the production method so that a thin-walled close-tolerance shape could be made with a minimum of secondary machining operations.

Although tooling costs were high, the Los Angeles branch of A. O. Smith Corp. felt that the product would benefit from the special tooling and production would be easier. Successful application of die casting was achieved after close cooperation with a local job-shop die caster.



BECAUSE OF the enlarged base, housing of this gasoline meter is produced in a die with eight moving cores. The die-cast housing normally functions under a pressure of 125 psi. Its one-piece design reduces assembly costs and avoids possible leakage points. Other precision die castings are used for major units in the meter.

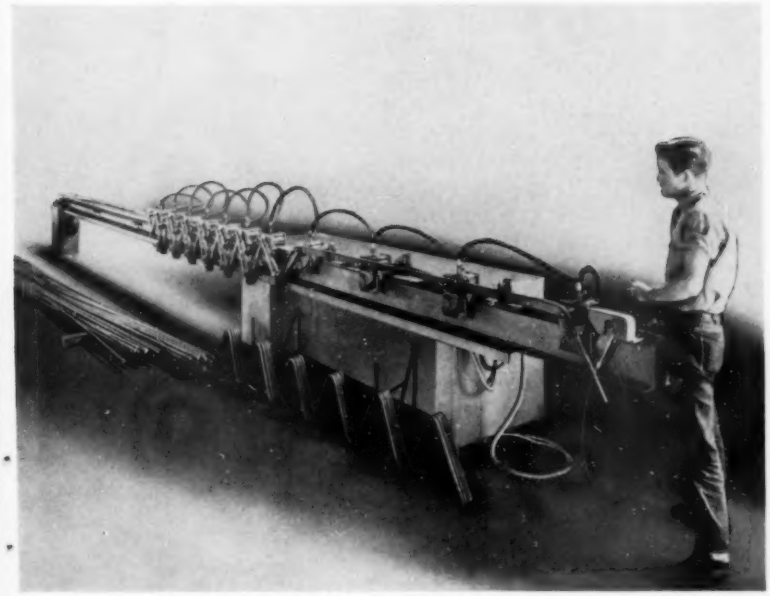
Inertia-Delay Clutch Operates Lapping Machine



Because lapping machines must start smoothly and receive constant, positive power during operation, an automatic clutch is desirable. If operation is not smooth, chatter marks may result. An inertia-delay clutch, developed by Mercury Clutch Div., Automatic Steel Products, Inc., Canton, Ohio, assures smooth and positive power input to this Norton single-face flat lapper.

The electric motors develop maximum torque during the starting period, when direct coupling is least effective and torque requirements are greatest. During operation, oversize friction areas in the clutch assure positive power without slipping. The clutch slips constantly when an excessive overload is applied, preventing damage to motors and wiring.

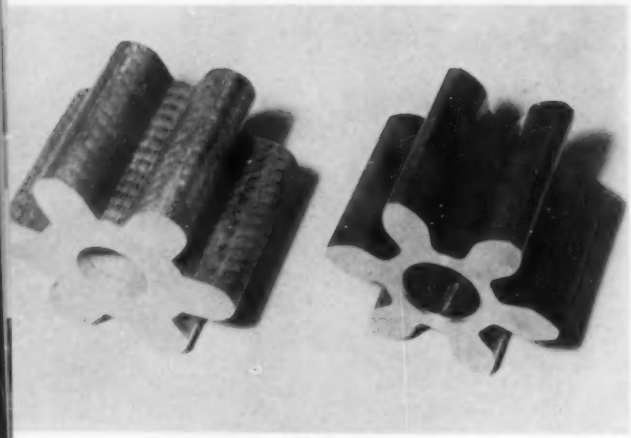
Bar Joist Center Webs Bent in Continuous Operation



Automatic machine bends center web sections of bar joist assembly with an estimated saving of 50 percent in time over hand work and individual bends. Rod is fed along the rail from the rear, crimped over end studs and folded in a series of jointed bender arms that work forward and close like an accordion. The finished bar is released as pneumatic cylinders retract bender arms for the next operation.

The machine is driven by a reversible gearmotor with a magnetic brake. Designed and built by the Eidal Mfg. Co., Albuquerque, N. M., it is capable of forming 6,000 bends per hour. Precisely bent center webs result in a more rigid joist because welding is facilitated.

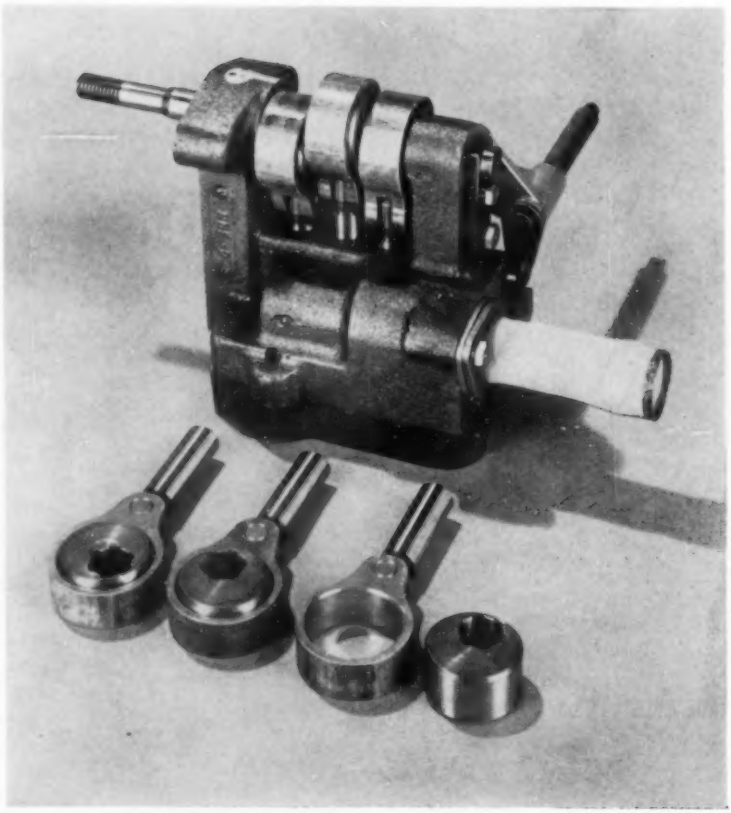
Continuous-Cast Shapes Save Money and Improve Performance



CONTINUOUS-CAST bronze stock is cut to length, left, at the Hale Fire Pump Co. to make pump rotors. One rough cut and one fine cut are all that are necessary to produce finished impeller teeth.

Improved "raw" materials are available to reduce the amount of waste during manufacture and to lengthen tool life. Bronze sections are continuously cast by American Smelting and Refining Co., Barber, N. J., to closely match end-product configuration.

The gravity-fed bottom-flow casting method produces sections that solidify from the bottom upward so that dissolved gases can escape without causing porosity. Since foreign matter floats on top of the melt, blow holes, hard spots and soft spots are avoided. Sections are formed by high-density graphite dies that are used just once.



KEYHOLE SHAPED section is continuously cast in 12-foot lengths. This bronze section is cut to required length for mass production of oil-pump connecting rods at the Pacific Div., Bendix Aviation Corp. Rods in various stages of assembly are shown with a complete pump. This method of manufacture has reduced costs and improved product performance.

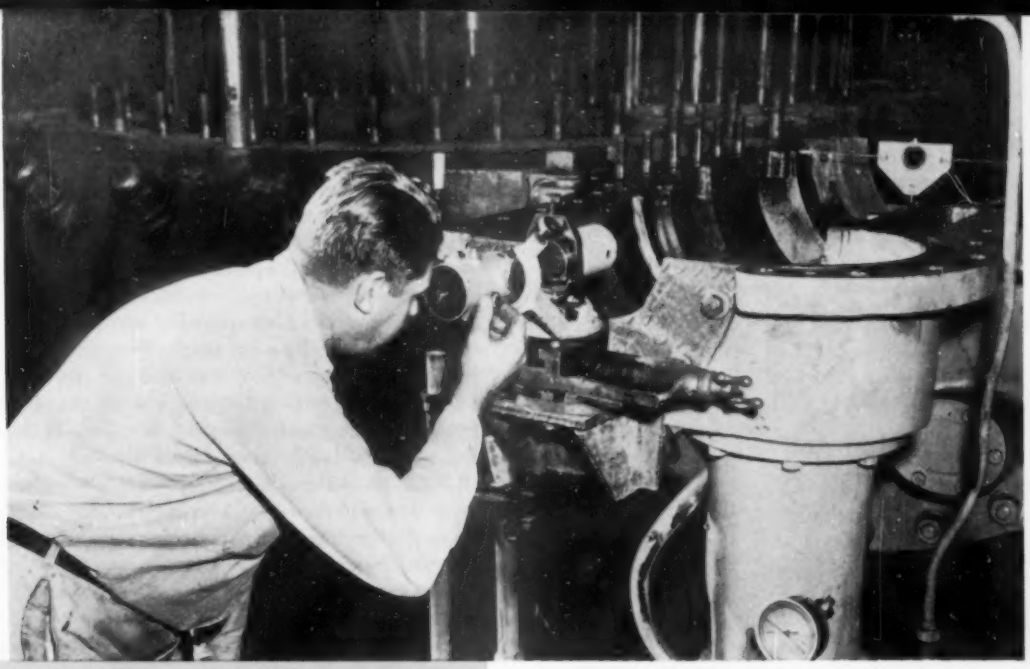


Fig. 1. Bearings of a large turbine generator are aligned with optical tooling equipment to assure high accuracy at low tooling cost with minimum expenditure of time.

how to use optical tooling methods

By Earle B. Brown
Chief Project Engineer
Farrand Optical Co., Inc.
New York, N. Y.

OPTICAL TOOLING is a basically different technique of precise measurement that can replace cumbersome and expensive methods used in the construction of large assemblies, jigs and fixtures. The technique was first developed to accelerate and simplify tooling procedures in order to speed production of aircraft and to improve the building of airframes to meet more rigid and more precise specifications as aircraft became larger and design more complex.

Such methods save time and skilled man power, thus achieving considerable reduction in costs of tooling and aircraft construction. For these reasons, optical tooling methods have been adopted, not only by the aircraft, but by other industries as well, *Fig.* 1.

Fundamental principle of optical tooling is that a ray of light is an accepted definition of a straight line. (Under special conditions, light may travel on a curved path—as in the formation of mirages—but this does not invalidate the general principle.) When optical methods are applied in the construction of a large jig, for example, they can obviate the need for angle plates, master squares, large and complex master checking fixtures, and the like. At the same time, precision is improved because accumulation of errors is avoided.

Initially, instruments for optical tooling were

improvised by tool engineers as their need arose. Usually, instruments such as transits and engineers' levels were modified on the job. Over the past few years, new types of optical instruments and accessories have been specifically designed for use as tools. Development of the optical bar principle, which is applied in conjunction with standard optical tooling instruments, has added versatility and opened new avenues for adaptation of optical tooling methods.

Application of optical tooling to the construction of a typical aircraft assembly jig will illustrate the principles and introduce the various instruments and accessories used.

An aircraft assembly jig consists of a rigid frame, frequently formed of heavy tubular members welded into a roughly rectangular shape. Such frames can be 100 feet long and 40 feet wide. Various jig fittings that serve to hold parts and subassemblies in position are attached to the frame, *Fig.* 2. Jigs are constructed for various large sections of the airframe, including those for parts of the wings, fuselage and stabilizers. As many as 10,000 man-hours can be expended during the construction of a single, large jig and dozens of jigs of various sizes are required for a production airplane model. Hence, possible savings of 25 to 40 percent, which have actually been realized through use of optical tooling, are significant.

Jig fittings must be located to tolerances of a few thousandths of an inch to maintain the accuracy of

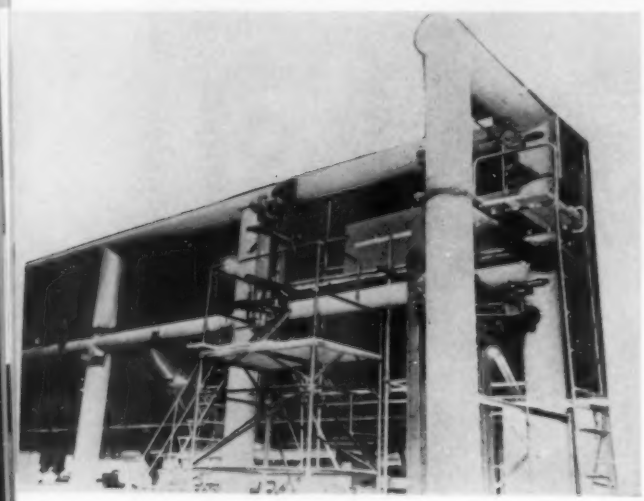


Fig. 2. (left) Section of a typical aircraft assembly jig indicating its massive construction. The frame need not be extremely accurate, but accessories mounted on it must be accurately positioned.

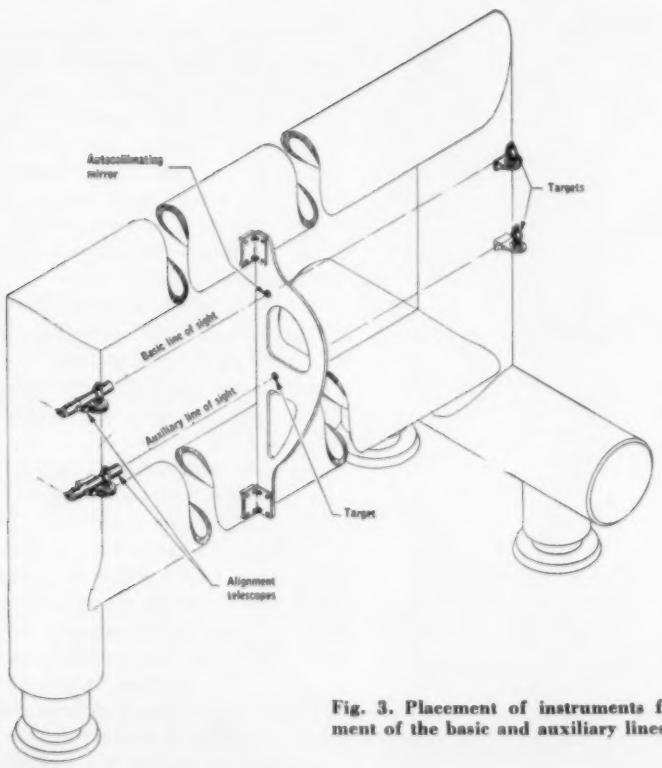


Fig. 3. Placement of instruments for the establishment of the basic and auxiliary lines of sight.

the assembled parts. To do this with classical measuring methods is a huge task. It necessitates the use of "leap-frogging" methods, which are always undesirable where high accuracy is important. It requires the preparation of complicated master checking fixtures, which are often so heavy they cause distortion of the jig frame when they are hung up on it. Classical methods usually require several men to work as a team to make the necessary measurements. By comparison, optical techniques are simple, accurate and fast. Long training periods for personnel are unnecessary.

The first step in the optical tooling procedure is to establish a basic reference line on the jig frame. This line serves as the fundamental reference for all subsequent measurements. To establish the basic reference line, an alignment telescope is attached at one end of the jig at a preselected point and a target is attached at the other end, *Fig.* 3. Telescopes and targets are made and mounting accessories are provided so their centers can be located to a tolerance of 0.001 inch. By sighting through the telescope and pointing its optical axis at the center of the target, an absolute straight line can be established between two points on opposite ends of the jig.

Alignment telescopes are made with high accuracy. Typical production models can be set to the center of a target with repetitive accuracy of ½ sec of arc, or 0.003 inch in 100 feet. Tolerances on concentricity of the spherical mounting ball and the cylindrical mounting surface, with respect to the optical exis, are 0.00025 inch. The cylindrical body is parallel to the optical axis within 1 sec of arc. In some alignment telescopes, a precision level permits establishment of the basic reference line in a horizontal plane within 2 sec of arc. A horizontal reference line is often desirable.

A fitting, which is to be attached to the jig, must actually be located in space. Such a fitting is provided with a target whose center is pierced by the basic reference line. The fitting can be thought of as a free body in a three-dimensional coordinate system, *Fig.* 4. It has six degrees of freedom—translation along X, Y or Z axes and rotation about axes parallel to these. For accurate positioning, the fitting must be located and secured in all six degrees of freedom. By centering the fitting target on the basic reference line, the fitting is prevented from translation along Y and Z axes.

If the surface of the fitting can be established perpendicular to the basic reference line, the fitting will be locked against rotation about the Y and Z axes. Surfaces can be located perpendicular to the basic reference line by either autocollimation or autoreflection methods. A plane mirror is mounted on a surface of the fitting that is to be oriented perpendicular to the line of sight. The alignment telescope is aimed at the mirror and can receive either the image of the illuminated reticle of the telescope, projected through the objective and reflected from the mirror (autocollimation) *Fig.* 5, or the reflected image of the target window on the telescope (autoreflection). The observed images will appear at the center of the telescope reticle only if the mirror is perpendicular to the telescope optical axis.

Autocollimation is twice as accurate and twice as sensitive as autoreflection, and is used wherever the greater accuracy is required. When precision need not be high, autoreflection provides an easier, quicker method. Magnetic mirrors are available for setting against an accurate ground or machined surface. Also, mirrors can be substituted for the standard target on the fitting.

If a second line of sight is established through a target in the fitting, rotation about the X axis can be prevented. The auxiliary line of sight can be established at any convenient location on the jig and need not be parallel to the basic reference line, althought it usually is, *Fig.* 3. Direct measurement with micrometers between the respective telescope and target mounts is usually sufficiently accurate to establish the auxiliary line of sight, especially if it is long. A more refined method of setting up an auxiliary line of sight requires the use of optical squares, which will be described later.

With the tooling already mentioned, the fitting can be locked against five of its six degrees of freedom. The only remaining freedom is for transla-

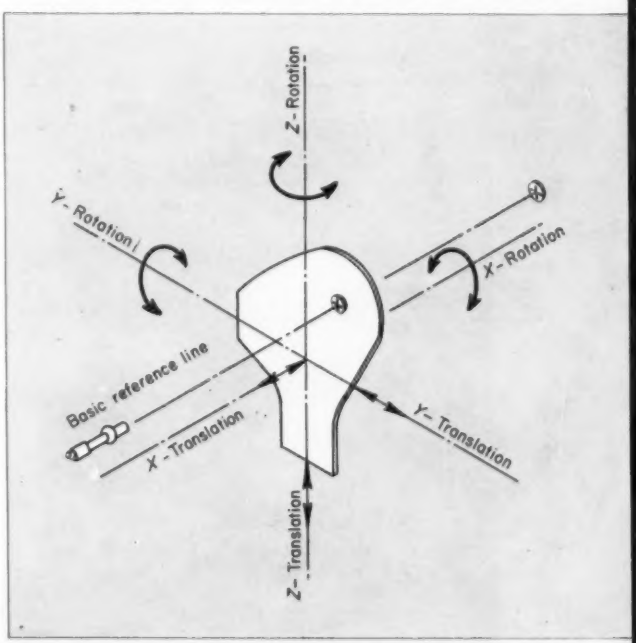


Fig. 4. Free body of a jig fitting showing the six degrees of freedom it possesses.

tion parallel to the basic reference line. Such motion is *X* translation, frequently referred to as longitudinal movement. During the development of optical tooling techniques, this movement has been the most difficult to control. It still requires the most equipment, but a procedure has been devised that makes the operation simple, accurate and fast. The technique is to locate the fitting at its proper distance from a zero reference near the end of the jig. The new procedure uses a tooling bar, *Fig.* 6, fitted with an alignment telescope, a target and an additional alignment telescope, with attached optical square, mounted on a movable carriage.

An optical square is an assembly of two precisely located mirrors, *Fig.* 7, similar to that used for end mirrors on range finders. This assembly is superior to the use of a mirror placed at 45 deg to the line of sight because it is a constant deviation device. The 90-deg deviation of the line of sight is not affected by any rotation of the mirror assembly about an axis parallel to both mirror surfaces. When mounted against the precisely ground rim of a telescope tube, the constant deviation axis of the square is perpendicular to the telescope optical axis.

When an optical square is used separately from a telescope, a mirror placed against ground pads at the exit face can be used to locate the constant deviation axis by autocollimation. A target is incorporated in the square for coincidence indexing.

If the optical square and its associated telescope are rotated about the telescope optical axis, the deviated line of sight will sweep out a plane normal to the telescope line of sight.

To establish jig fittings along the basic reference line by using a tooling bar, a simple procedure is followed. The tooling bar is set up on the floor at any convenient distance, 10 feet or so, from the jig. A control telescope and target at opposite ends of

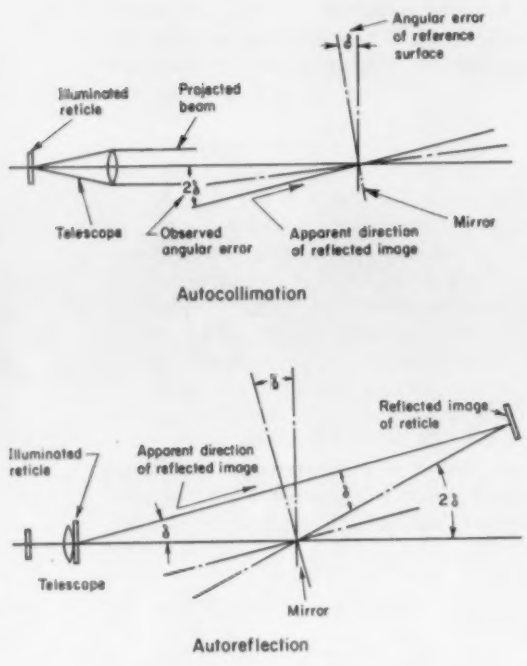
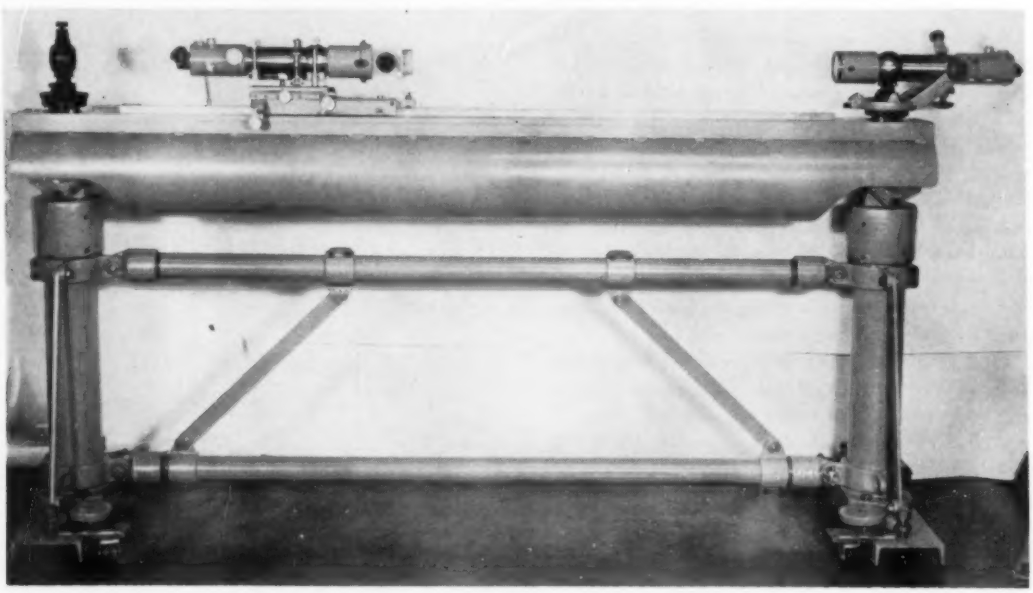


Fig. 5 (left) Diagrams of principles of autocollimation (top) and autoreflection indicate why the former is twice as sensitive.

Fig. 6. (bottom) Basic tooling bar setup comprises the bar, an alignment telescope and target, and a carriage-mounted alignment telescope with attached optical square.



the bar establish a tooling bar line of sight that is positioned parallel to the basic reference line.

A tooling bar carriage, which carries an alignment telescope and optical square in an adjustable cradle, is mounted on the tooling bar and can be indexed to stations along the bar by means of index holes in the bar and carriage. Holes are spaced five inches apart on the tooling bar, for example, and five holes one inch apart are provided on the carriage. These holes are accurately located and bushed. Through use of a locking pin, they can be located precisely at 1-inch stations anywhere along the tooling bar. A micrometer screw on the carriage permits location of the carriage at one-thousandth-inch increments between the one-inch stations. Thus, the line of sight emerging from the optical square can be located anywhere along the bar in increments of 0.001 inch.

After the appropriate station has been selected, the telescope on the tooling bar carriage is collimated to the control telescope on the tooling bar by the simple procedure of looking into one telescope with the other. One of the mirrors of the optical square is semitransparent and fitted with an external cover.

With the carriage telescope aligned parallel to the tooling bar line of sight the plane swept out by the optical square will be normal to both the tooling bar line of sight and the basic reference line on the jig. By using the tooling bar line of sight instead of a mechanical line, perpendicularity of the station planes to the basic reference line is assured even in the presence of distortion in the tooling bar.

When the carriage telescope has been collimated to the tooling bar line of sight, the optical square may be rotated to sweep out the station plane and to observe targets on the fitting, *Fig.* 8. This final step locks the sixth degree of freedom and insures accurate location.

Complete location of the fitting requires a minimum of three targets and four independent adjustments. An alternate way of locking the fitting against Y and Z rotation is to use three targets whose centers lie in a plane perpendicular to the tooling bar line of sight. These three targets are all checked with the optical square. This method is used with large fittings where the base line available to an autocollimating mirror is not sufficient to properly locate the fitting or where the fitting

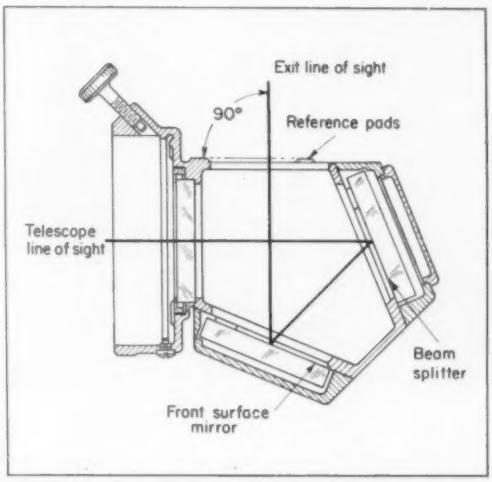
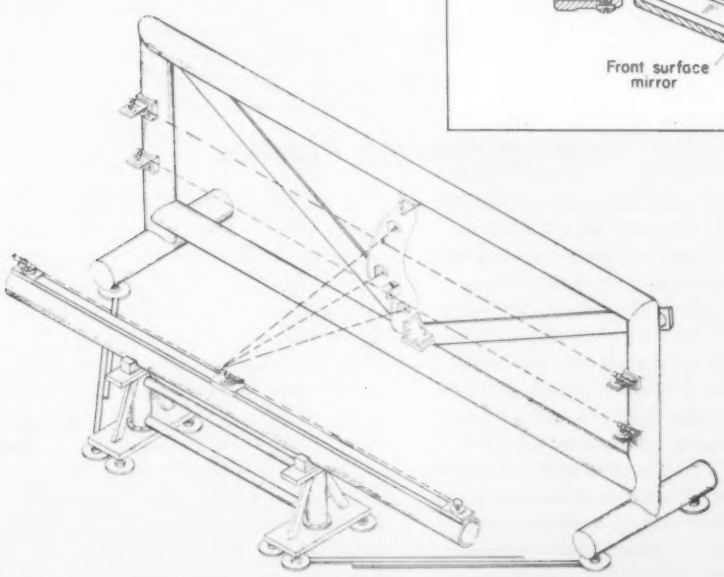


Fig. 7. (right) Deviation of the line of sight is exactly 90 deg when the two mirrors of an optical square assembly are correctly positioned.

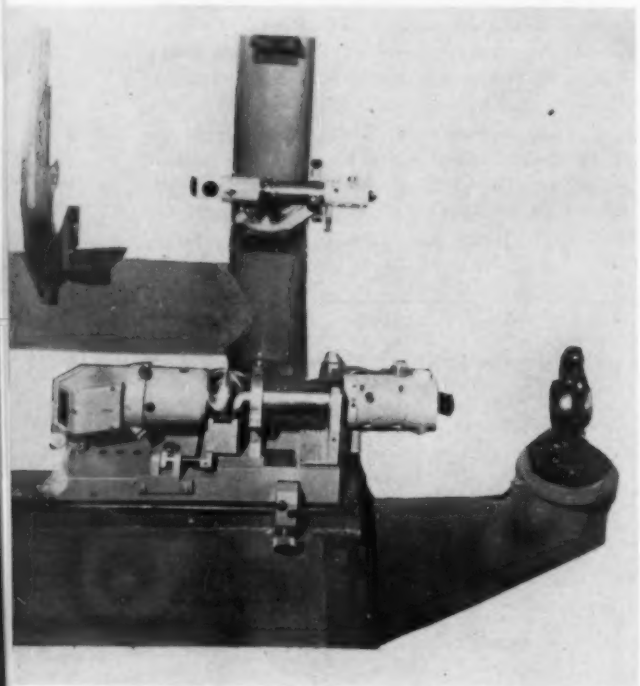
Fig. 8. (bottom) Use of a tooling bar to locate fittings in a station plane.



may be placed at an angle rather than perpendicular to the basic reference line.

The procedure for setting the tooling bar line of sight parallel to the basic reference line is simple. An identical procedure can be used for establishing the auxiliary line of sight on the jig. In the following discussion, the basic reference line telescope is referred to as No. 1, the tooling bar control telescope is No. 2 and the telescope on the tooling bar carriage is No. 3.

Fig. 9. Lines of sight can be made parallel by collimating two alignment telescopes to each other through optical squares. If both telescopes are horizontal, lines of sight are parallel in every respect.



Telescope No. 3 is collimated to No. 2 in the same manner as when setting a station. Telescope No. 3 is then parallel to the tooling bar line of sight. An optical square is placed on No. 1, and Nos. 1 and 3 are collimated by looking into each other through their respective optical squares, *Fig.* 9. Jacks are provided on the tooling bar so that it can be adjusted to produce this collimation.

This procedure establishes the two lines of sight, basic reference line and tooling bar line, parallel to each other, except with respect to rotation about the line joining the two optical squares. The necessary second restraint is imposed by making both lines of sight horizontal through use of the levels on the alignment telescopes. If the basic reference line is not horizontal, a slight variation of the procedure is necessary.

One of the most important advantages of the method which uses a tooling bar carriage is that only one man, at the carriage, is required for the entire measurement job. With this method, setting time for establishing a station reference is less than a minute, and it has proved feasible in actual practice for one man to work several stations simultaneously.

Optical tooling methods are simple and accurate for locating and positioning over long distances and large areas. While the principal application of optical tooling methods has so far been in the aircraft industry, their usefulness is by no means confined to that field. Such methods have already saved many man-hours in the alignment of large turbine and generator bearings, *Fig.* 1 and in the alignment of large machine tools. An expanding future is predicted for this method of accurate measurement.

Savings through Plastics

RAPID FABRICATION possibilities, light weight and durability which mean time and labor savings for the manufacturers are qualities which are bringing about constantly increased use of plastics. Current uses, according to Frank L. Bogart of Marblette Corp. speaking before the American Society of Body Engineers, are as dies for short-run production stampings, phenolic dies to produce prototype automobile panels, or tools cast from self-curing epoxy with a low-cost foam core. Such uses permit reduced number of tooling operations with a consequent high savings in production by automotive concerns and other firms involved in metal-forming operations. One automobile manufacturer estimates a savings of as much as $250,000 in a single phase of production because of its ability to alter plastic dies as often as four or five times a week to make satisfactory corrections before long runs.

There also is constant progress in experimental work on plastics. Currently under test is a core resin with a high compressive strength for heavy-gage work. According to expectation, this material, which requires only a short heat cure, may provide a method of casting dies without a laminate for short runs of 0.030 to 0.040 steel. Among other developments which may be announced shortly are nontoxic hardeners for epoxy resins; foam epoxy for setting at room temperatures; and a metal-filled epoxy for casting which offers heat resistance of 300 F and fairly high heat conductivity.

making spray painting operations

AUTOMATIC

By Eric H. Cocks*

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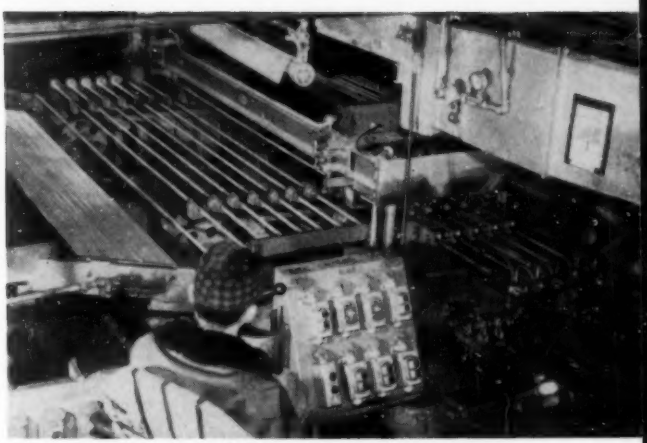

Fig. 1. Special guns fitted with long extensions spray inside of electrical conduit.

PROBABLY the most widely used method of applying industrial finishes is spray painting. It is suitable for all types of modern finishes, many of which can be handled in no other way. Although manual spray painting is widely used, there has been a decided trend toward semiautomatic and completely automatic spray painting operations, *Fig.* 1.

Recent emphasis on automation throughout industry has also been reflected in spray operations with more manufacturers becoming aware of advantages of a completely automatic process from start to finish, including painting.

One of the most obvious advantages of automatic painting is that it results in a reduction in direct costs. With the rate of production set automatically, the finishing department need no longer be a bottleneck. Automatic processing generally provides a finish superior to that obtained manually and results are repeated indefinitely. There will usually be savings in materials and other advantages associated with mechanized operations.

Preparation for Spraying: Procedure for preparation of an article for automatic painting will not greatly differ from that for the manual process. In other words, the article must have a surface which is acceptable for the type of coating to be used. The pretreatment should always consider the coating system as a whole, and the paint supplier should be consulted in the early stages of planning.

Automatic equipment differs from manual painting in that a batch system is seldom used. Parts are carried through a continuous cycle, and operators merely load and unload, adjust, mix paint and clean equipment.

Equipment needed for automatic spray painting will vary from the simplest timer operated gun, to a modern complex mechanism. The system requires a method for carrying the part to be painted, correctly locating it during the painting and supporting it until the finish has dried sufficiently for it to be removed from the holder. The conveyor must return the holder to the loading station. Also, drying or baking equipment, exhaust system, safety

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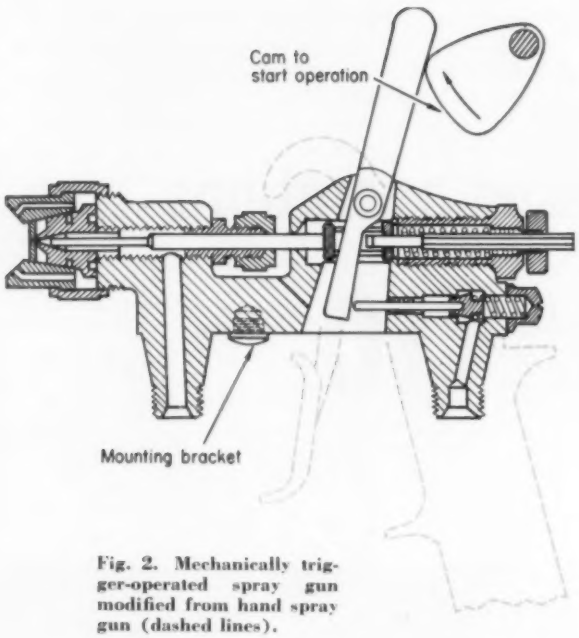


Fig. 2. Mechanically trigger-operated spray gun modified from hand spray gun (dashed lines).

equipment and miscellaneous painting equipment such as tank, hose, filters and compressor are necessary.

The secret of successful automation of spray painting is an understanding of the basic principles involved. In tooling up for spray painting a knowledge of the types of automatic guns and how they can or cannot be used is invaluable.

Gun Types: There are four main types of automatic spray guns: mechanically triggered guns, solenoid-operated guns, air-operated guns and straight spray heads. Automatic spray painting setups are designed around them. They have been developed from standard hand spray guns, using the principal operating parts and adding triggering devices. Special types of guns, such as those for applying silver backing to mirrors, catalyst type guns which apply two materials at the same time, sanitary guns, etc. are beyond the scope of this article.

In a typical hand gun, a trigger depressed by the operator turns the gun on and off. For correct spraying characteristics it is essential that the air be turned on before the fluid, and that the fluid be turned off prior to stopping the air. This is taken care of by the mechanics of gun design.

One form of automatic spray gun replaces the hand trigger with a straight rod on which a cam, clevis or lever can be mechanically connected to some operating part of the machine, *Fig.* 2. Broken lines in the drawing indicate the hand spray gun from which it was developed. This type of gun is mainly used when there will be no necessity for moving it from its initial position. It can readily be seen that if it is moved, the original operating mechanism will no longer be satisfactory.

A second type of gun, sketched in *Fig.* 3, replaces the trigger with a solenoid; an electrical impulse pulls the trigger to start the spray. Such guns are more flexible than the semiautomatic gun. They can be fitted on an adjustable mounting and the electrical cables connected to them may be placed as required. One drawback, however, is the fact that in most cases, particularly in the immediate vicinity of spray-painting equipment, explosion-proof installations are necessary. Also, the initiating switch or relay must be protected from paint which could gather on its working parts and cause malfunctioning. The necessity for explosion-proof equipment makes the use of air-operated guns attractive.

The air-operated gun is the most flexible of all. It is lightweight and compressed air, the source of control and operation, is always present at spray operations. Installation of both gun and controls can be made by relatively unskilled help. It is trouble free and an accumulation of paint will seldom prevent it from functioning. This type of gun was first developed from the semiautomatic gun by the addition of a small pneumatic cylinder, replac-

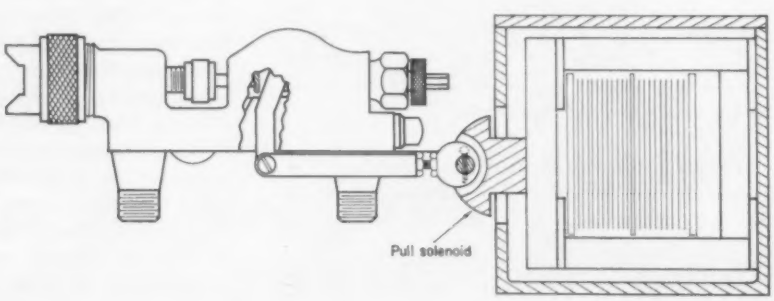


Fig. 3. Electrically operated spray gun. Solenoid triggers gun when energized.

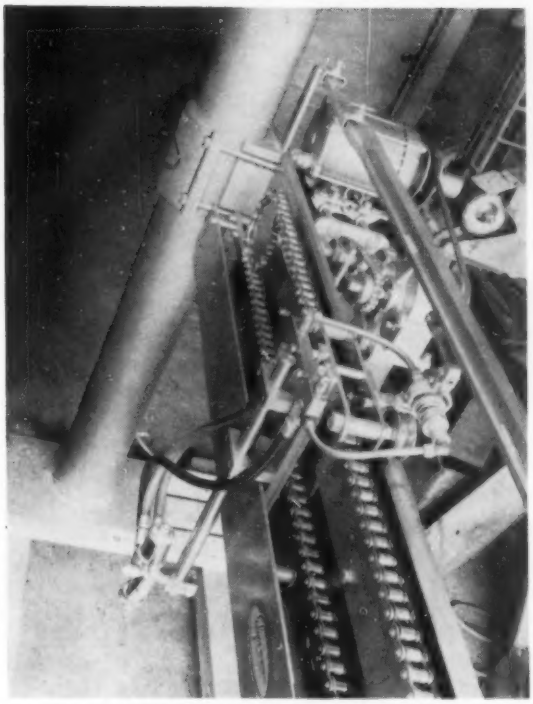


Fig. 4. Setup for coating flat surfaces. Air-operated gun is mounted on reciprocating mechanism which straddles the conveyor and traverses back and forth, as wallboard is passed underneath.

ing the solenoid. The latest development, shown in *Fig.* 4, is basically a small pneumatic cylinder incorporated as an integral part of the gun. This design provides trouble-free operation. The gun, designed for use with high-speed automatic equipment includes such features as quickly removable and replaceable plungers, locked click-stop adjustments, smooth contours for cleaning and solvent-proof packings. The mounting usually employed with an air-operated gun is a reciprocating or traversing mechanism.

In high-speed automatic applications, where minimum maintenance is essential, spray heads are sometimes used. The spray head has no moving parts, so that the fluid and atomizing air, if necessary, are controlled by separate exterior valves. These valves are triggered by impulses or signals from some part of the machine mechanism, which must be timed to the spray head so that the "air-on, fluid-on" sequence is followed. Such applications should be designed by specialists in the field of spray automation. The use of this type of spray head should never be undertaken where a fine contral is required, unless a thorough investigation has been made by an engineer familiar with spray painting requirements. Five heads of this type are shown on the automatic conduit coating unit in *Fig.* 1.

Selection of Nozzles: Spray guns are suitable for spraying almost any finish. Use of fast-drying lacquer, however, can result in savings in initial investment for equipment because it involves the shortest conveyor and minimum drying equipment. Such a lacquer will generally require the use of an external atomization nozzle. This type of nozzle mixes the air and fluid outside the nozzle as shown in *Fig.* 5. A fairly high air pressure and volume are required. Air pressures will likely range from 45 to 90 psi, depending upon the material viscosity, speed of application and other factors. The shape of the applied pattern can be varied by changing the amount of air admitted to the side holes.

For slow drying materials, such as synthetics, enamels, nonpigmented lacquers, oil paints, etc., an internal atomization type of nozzle is most satisfactory. It also is shown in *Fig.* 5. This nozzle requires much lower air pressures and volumes than the external type and will apply a wetter coat with less overspray.

Air pressure generally used for the purpose will range from 15 to 45 psi, with the fluid pressure usually about 5 psi lower than the air pressure used. Shape of the applied pattern is determined by the slot in the nozzle. This eliminates the hazard that an inexperienced operator will change a preset spray pattern, which is already giving the desired results.

Important to automatic spray painting is the use of extension nozzles. These are most often used to reach hard-to-get-at interior surfaces, generally employing internal atomizing type nozzles.

Types of Products: Workpieces can be divided into three categories: two dimensional surfaces, regularly shaped objects and irregularly shaped objects. The latter two may be further subdivided into internally and externally painted objects.

A typical example of two dimensional or flatwork painting would be the coating of leather hides or wallboard by the type of machine shown in *Fig.* 4. This machine straddles a conveyor on which flat types of work are carried underneath the gun as it traverses back and forth. In some cases, a variety of small, nearly flat objects are coated on a machine of this type by using a wire mesh belt conveyor. Pieces such as cigarette cases, flat stampings and small castings can be handled in this manner.

A three-way valve is used to turn the gun on and off. This is mounted on the same carriage that carries the gun. At the end of each stroke, a straight cam depresses the valve lever, turning the gun off. The carriage is moved by a projecting link extending through the chain. This link rides in a slot in the carriage and effects its reversal when the link travels around the sprocket.

Regularly shaped objects for which standard ma-

chines are suitable include such items as military shells, lamp shades, golf balls, fountain pen caps or almost any object which might be easily rotated about its axis. These are usually carried on a spindle chain conveyor or an indexing turn-table. The work is rotated at a comparatively high rate of speed. Usually the part rotates about 3 or 4 turns while being sprayed. This results in a firmly adhering coating. Precision cutoff at a point is not critical. Where possible, the work should be stationary in relationship to the gun during the spraying period, as this will minimize offspray and permit the most consistent results. This may be accomplished by indexing the conveyor or turntable, or synchronizing the guns so that they move at the same rate of speed as the work.

A small self-contained spindle-chain conveyor used to apply clear lacquer to the outside of fountain pen caps at better than 2,000 pieces per hour without indexing is shown in *Fig.* 6. The solenoid gun is controlled by a limit switch tripped by the spindles as they approach the spray station. The unit carries its own exhaust booth and infrared drying oven to speed drying the clear lacquer.

Examples of an irregularly shaped workpiece would be chairs, vacuum cleaners, large boxes or machine parts. If these article were rotated rapidly, they would tend to oscillate and their surfaces would be at varying distances from the guns. Usually carried on an overhead conveyor, spindle conveyor or rotating table, they are rotated comparatively slowly during the spraying period.

An excellent application points up the way automatic guns can save costs on an existing installation. The problem was to economically apply black lacquer to a magnet assembly such as is used in a household type electric meter. A conveyor already carried the magnet through a spray booth where an operator sprayed each one as it was rotated while passing. Rejects were high and sufficient speed could not be maintained.

The addition of three air-operated guns, plus a photoelectric eye and timer made the operation automatic and resulted in a superior repetitive finish, using less material, *Fig.* 7. The work interrupts the light beam as it approaches the booth, starting a synchronous motor timer, set so that it will open a solenoid valve as the magnet arrives in front of the spray guns. The solenoid valve admits air to actuate the spray gun and a similar timer holds it open until the magnet is sprayed. Such an installation could be easily engineered and is typical of many money-saving installations in which manual methods are converted to automatic.

Special Machines: Addition of a specially designed piece of equipment often can save costs and increase production. In one application, gas cylinders in three sizes must be painted with two separate colors. Previously, these were carried along on an overhead conveyor with the cylinders automatically rotating as they passed through a spray booth. Two operators were stationed at this position. The first man sprayed the lower color and the second man sprayed the upper color. The line of demarcation was always fuzzy and varied in location.

Automatic equipment added to the conveyor consists merely of a vertical type reciprocating machine driven by an air motor. Suitable valving together with selector switches determines the length of spray time of the guns. Two guns are used, one for each color, together with a fixed shield to insure a clean junction, *Fig.* 8. Selector switches permit an attendant to make changes so that the gun spray period is automatically suited to the size of cylinder being run. The first cylinder trips an initiating valve, which through pilot valves turns on the air motor and the guns travel up the cylinder, spraying as they go. An integral valve trips the pilot to stop the motor when the spray is completed. As an air motor and air valves were used, no electrical wiring was necessary, making for an installation with a minimum of lost production during the change-over.

Inside Coating: A regularly shaped object that requires coating on the inside might be a can, drum, barrel, military shell, tube or pipe. A blitz gasoline can or an irregular washing machine tub is a good example of an irregular painting job. Such jobs

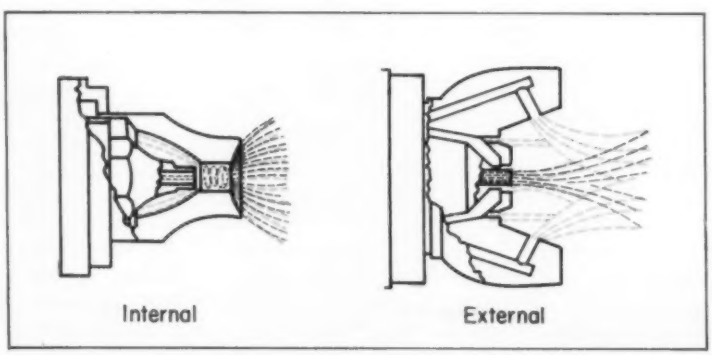


Fig. 5. Two types of nozzles. In the internal type, the air jet atomizes the paint before passing through the nozzle. In the external type, air jets atomize the paint after it leaves the nozzle.

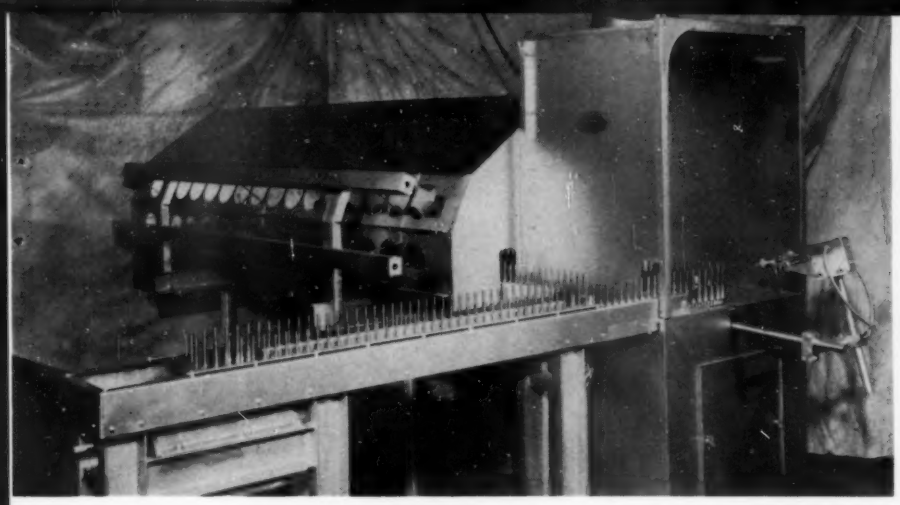
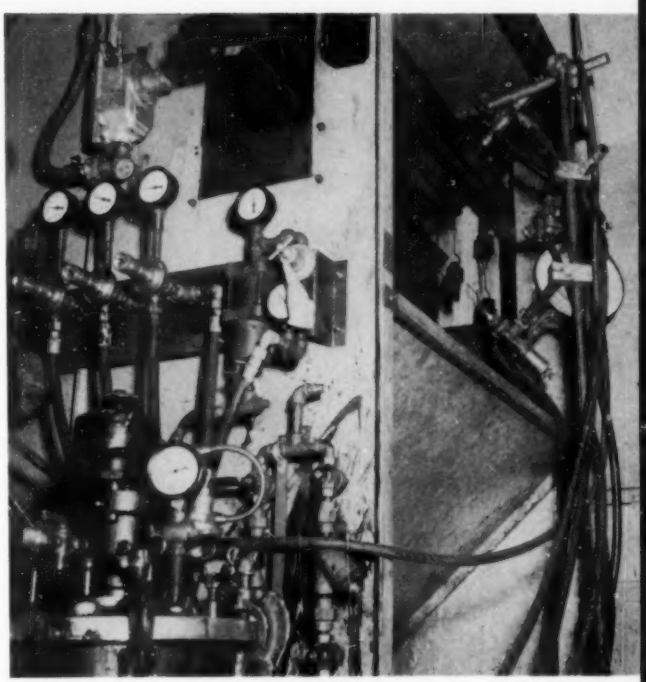


Fig. 6. (left) Solenoid gun applies clear lacquer to outside of fountain pen caps carried on chain conveyor. Installation includes infrared drying oven and exhaust system.

Fig. 7. (below) Spray coating installation for magnet assembly was modified by addition of photoelectric eye, automatic guns and controls, making the operation automatic.



are a little more difficult than the others outlined. Each must be considered on its own merits before proceeding with equipment selection.

An electrical conduit being painted on the inside by long extension nozzles mounted on straight spray heads is shown in *Fig.* 1. An important feature to be remembered in designing for interior painting is that solvent washing is always present and will sometimes spoil an otherwise perfect finish. Solvent washing is caused when lacquer solvent fumes, which cannot escape from the enclosure, dissolve some of the deposited lacquer film, softening it enough to allow curtains or sagging. This condition can be prevented by using a low-pressure air blast to remove fumes immediately after painting. Also, rotating long tubular objects immediately after the spraying operation minimizes the problems of sagging.

Design Vs. Cost: Design of any machine is a compromise. Usually it will combine many excellent features along with some which appear to be less desirable. This results because it is necessary to consider production, initial cost, ease of maintenance, ease of loading and unloading, installation requirements, shopping facilities, operator intelligence and other factors.

Cost is greatly influenced by production requirements and drying time. For example, *Fig.* 9 shows a 4-foot indexed turntable which is being used to apply a fast drying lacquer to the outside tail assembly of a rifle grenade. It contains its own spray booth and steam-heated drying oven, and uses air-operated guns with a fast-drying lacquer.

This particular table is indexed by a geneva type drive, with the work being rotated during the dwell period. At this time an adjustable cam, geared to the driver mechanism, turns on the spray guns through a cam-operated three-way valve. Production requirements are 600 pieces per hour. The lacquer requires a drying time of three minutes.

If the drying time could be halved, the same machine would produce 1,200 pieces an hour. Similarly, if the drying time were doubled, production would be cut to 300 pieces an hour. If production must be maintained at 1,200 pieces an hour and the drying time of six minutes could not be lowered, the indexing table could no longer be used. Instead, a chain type conveyor would be required with approximately 150 spindles, compared with the 36 spindles used on the circular table. These spindles would require additional tracks, supports, horsepower, shafts, sprockets, extra maintenance and the like. Also there is no type of chain conveyor which will hold a product as steady as the turntable.

The turntable also lends itself to inside and outside spraying, whereas a chain conveyor is less reliable where inside painting is to be done through

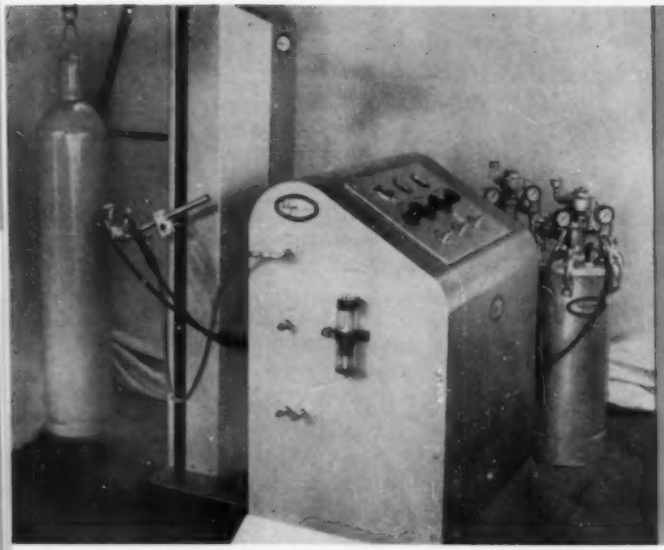


Fig. 8. Special machine developed to paint acetylene cylinders two colors. Automatic air-operated guns are utilized.

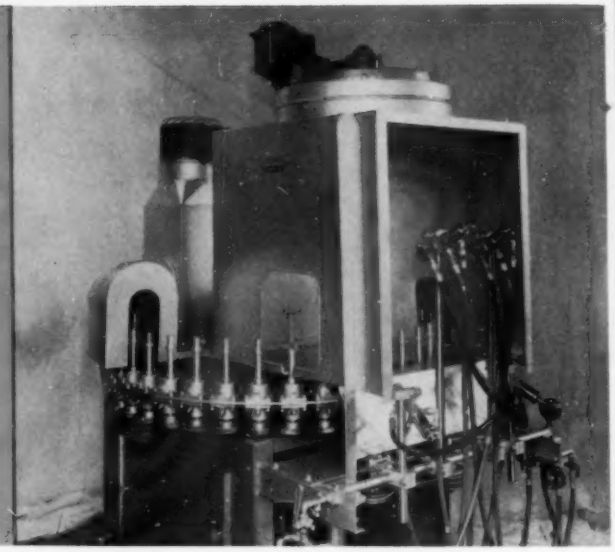


Fig. 9. Automatic spray-painting installation utilizes indexing table and four fixed guns to apply finish to a military unit.

a small hole. The turntable unit is most generally used with a lacquer system where a minimum of baking or drying equipment is necessary.

Design Factors: In designing automatic equipment, it is most important that every effort be made to obtain a unit which will approach perfection as nearly as possible. Strong consideration should be given to the fact that perfection in theory is seldom obtained in practice. Where automatic equipment is fitted into a production line, provision should be made so that it is flexible enough to cope with any foreseeable situations which might arise. These could include the desirability of passing the article to be sprayed through the machine without painting, the ease with which maintenance can be carried out, and the possibility of changing a product design which would require a slightly different spraying operation.

The machine should be designed as simply as possible in keeping with the work it is to do. It must be sturdy, with special attention given to the spindle or holder that will carry the work. Mechanical movements should be designed so that they will be positively operated. In many cases maintenance will be neglected. It is important to keep this in mind. Also, there may be times when paint is allowed to accumulate on moving parts of the machine. If this fact is ignored, so much paint may build up on a part that it will not function.

Usually motors must be explosion-proof. All electrical equipment should be enclosed, as paint on contacts causes trouble. Often the use of hydraulically operated components will be advantageous. On the simpler type of machine, pneumatic operation is convenient. On high production machines, it is essential that sufficient safety devices be included so that the machine cannot damage itself or the work if a stoppage should occur. Controls should be as simple as possible and should be interlocked so that malfunctioning cannot occur through negligence of the operator. Production speed should be easy to change where required.

Work-Holding Fixtures: Of extreme importance in any automatic spray equipment is the fixture which holds the work. In most cases, the work should rotate. It is most desirable that the spindle be heavier than normal design practice requires and that it be carried in self-aligning ball bearings.

Sealed bearings are essential to eliminate the possibility of paint clogging the spindle, preventing correct rotation. Sometimes it is possible to design a spindle which will carry the object to be painted and also shield certain parts which should not be painted. Such a rotating spindle is shown in *Fig.* 10, designed for outside coating while at the same time an extension nozzle enters from beneath through the hollow spindle to spray the inside.

For holding small parts, permanent magnets can often be adapted to advantage. Where parts are to be hung from an overhead conveyor during the painting cycle, it is likely that the hanger will also be coated. It should be designed so that as little area as possible will be subjected to the spray. Such hangers should be easily removable from the main conveyor for periodic cleaning.

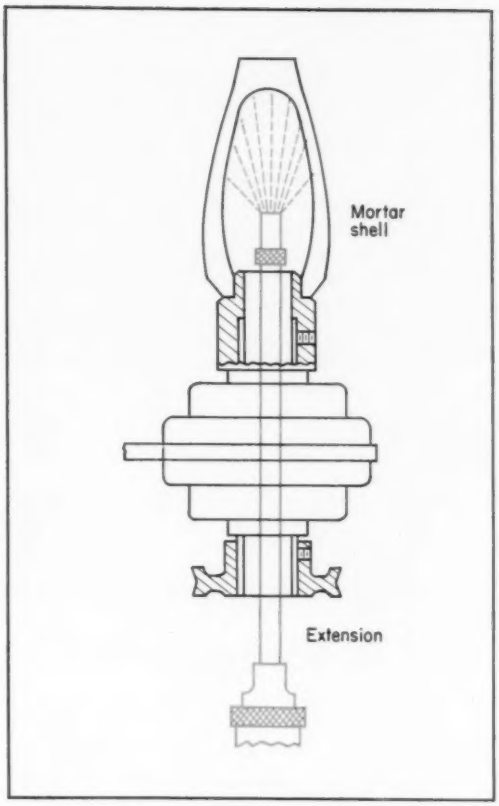


Fig. 10. Internal spray setup designed to coat only desired area. Extension mounted on gun withdraws to clear base of spindle, permitting table to index.

Auxiliary Equipment: An item which reflects on final cost of an installation, but which can be varied, is the amount of auxiliary equipment supplied. Particularly where multiple color or frequent refilling of tanks is required, it is desirable to have additional paint supply tanks manifolded together. A separate tank manifolded into the system to be used only for solvent for cleaning is a great time saver. Every installation should have adequate capacity of air filters. With multiple gun installations the use of fluid regulators and individual air regulators for each gun is desirable.

All of these accessories increase the cost of the unit but they also make for easier operating and maintenance, and result in better control of equipment and finish. If a material which rapidly settles out is being used, such as a heavily pigmented metallic paint, it is most desirable that the tank have a built-in agitator driven by an air motor.

Automatics in Production: When considering automatic equipment, it should be borne in mind that there is no such thing as a push-button unit which can be installed, started and given no further attention. This is especially true of painting equipment. Many variables require attention of a human attendant. Viscosity of the paint may change, factory air pressures can drop, guns and nozzles need cleaning. Quality control or inspection may call for more or less paint. There may be color changes required for certain products. In most cases, it is profitable to use an experienced spray painter for these duties. A must is intelligent supervision, capable handling and realization that sufficient time must be provided for cleaning and maintenance.

Other Applications: Spray painting equipment can be used for many purposes not directly connected with the finishing industry. A sanitary air-operated gun applies a sugar wash to cookies in a large bakery. The gun is made of stainless steel and is designed for easy cleaning. This application uses internal nozzles requiring about 10 psi air pressure. Exhaust equipment is not needed.

Automatic spray guns are also widely used to apply greases, lubricating oils, polishing compounds and parting fluids. Timed greasing of open type gears in large mills is often carried out with an air-operated gun activated at the required period by a pneumatic timer. This eliminates a dangerous and time-consuming operation.

Exhaust Equipment: Exhaust equipment required for a spray application will vary with the type of installation, local regulations, material being used and frequency of spraying. Dry booths, as shown on the various units previously discussed are satisfactory in most cases and require only moderate maintenance. A waterwash booth, in which the oversprayed fumes are washed clean of solvents and pigments before exhausting to the outside air is often used. Such booths are more expensive than dry booths and require additional maintenance. Explosion-proof motors and controls should be used on all spray booths. Fans should be enclosed, with no open belts in the duct work. Fan blades should be of nonferrous material. When cleaning such booths, nonsparking tools must be used.

In designing a booth, local or state labor ordinances must be observed. Generally speaking, a face velocity across the open front of the booth of approximately 125 to 150 feet per minute is satisfactory.

Tryout Period: When first installed, anything other than the simpler type of automatic unit may require more attention than may have been anticipated. Adjustments necessary, however, rapidly diminish, as experience is gained with the unit. The know-how gained from experience becomes invaluable. In some cases, a problem may be solved merely by changing a nozzle or pressures.

Opposite Page—BROACHING THE PANRAIL and top faces of a V-8 block is done in this large-scale broach at a rate of 150 per hour. Only half of the unit is shown. The operator is standing at the central loading station. Above, in the circular housing, is the planer type drive, comprising worm and pinion powered by a 250-hp motor. In this combination one-way and two-way horizontal broach, tools are positioned vertically and the blocks are tipped over in a fixture to contact them. This permits chips to fall clear of fixture and tools, also allows rapid inspection of tool bits in the moving broach slide as it travels over the stationary work. The machine uses 800 tools of the carbide insert type in planer bits 1 inch square. For easy replacement and regrinding, bits are of standard length, the broaching action being obtained by insertion of graduated step blocks behind the bits. About ¼ inch of stock is removed from the broached surfaces. The loading and unloading fixture is hydraulically actuated, with a 25-hp motor used to drive hydraulic pumps. From broaching, blocks proceed to stations for milling end faces.

TOOLS at work

Tooling, Automation Matured At New Ford V-8 Engine Plant

Reflecting notable advances in tooling, layout and material handling, Ford Motor Co.'s newest V-8 Engine Plant No. 2 in Cleveland adds 562,000 square feet of floor space to engine production facilities.

Machining operations at the new plant are virtually 100 percent carbide tooled. Improvements in automation devices, involving principally a change from air to hydraulic actuation, have permitted a more compact grouping of equipment.

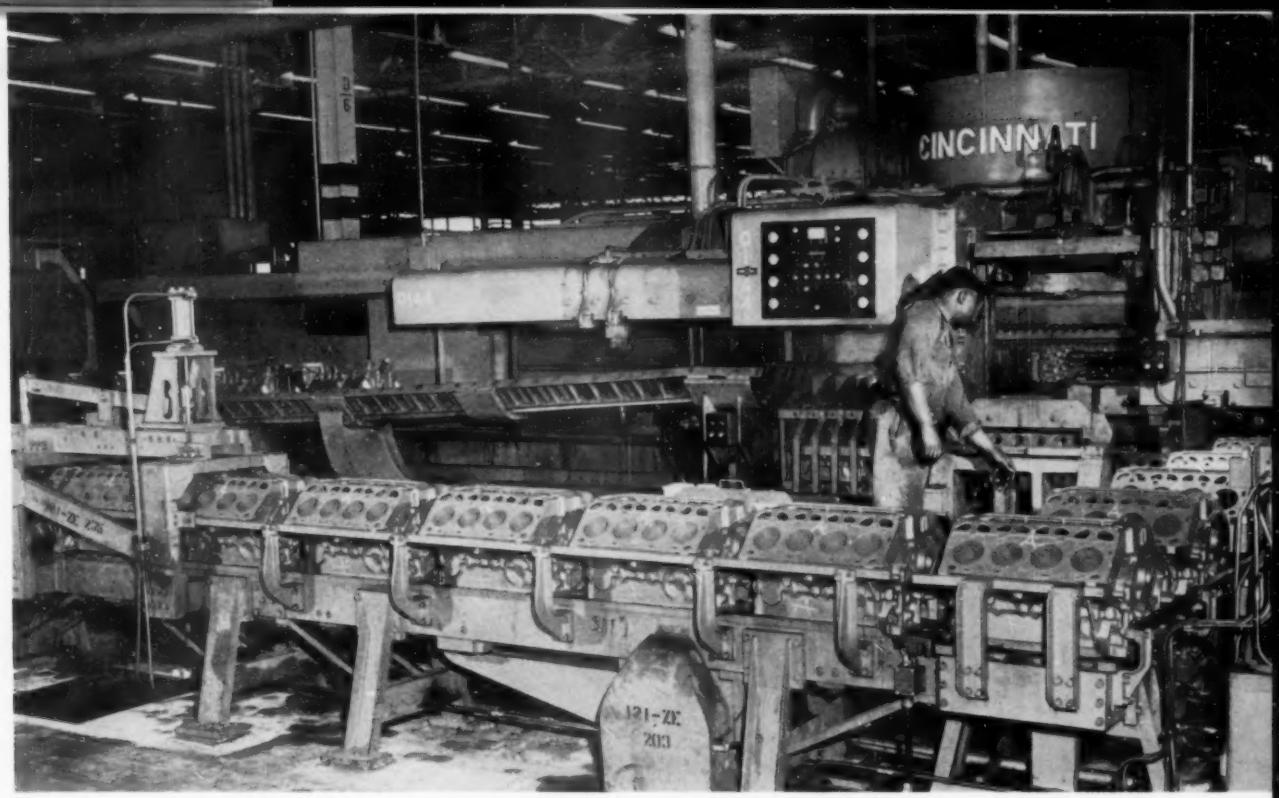
A network of 14 interlinked but separate power-and-free overhead monorail conveyor systems has expedited production flow. In the event of a breakdown at any point in the operation, engines can accumulate on "free" conveyors ahead of the breakdown, without shutting down the entire plant.

Engine assembly fixtures incorporate switch mechanisms which are set to control automatically routing through assembly and to the 44 final hot test stands. A departure is the skipping of engines filled with oil.

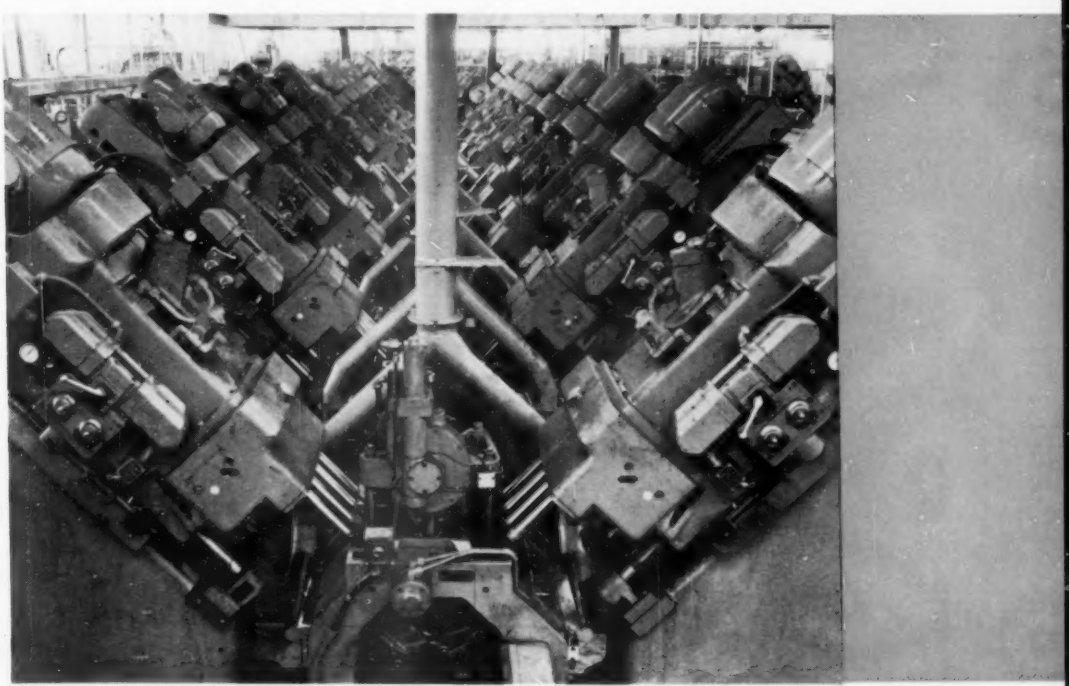
Another innovation is the use of a TelAutograph hookup for communicating details of cylinder bore and crankshaft dimensions to assemblers of pistons and connecting rods so that matched sets may be dispatched by conveyor to arrive for selective fitting to the proper engine at the proper time. This avoids a large float of piston and rod sets which come in as many as 11 size ranges.

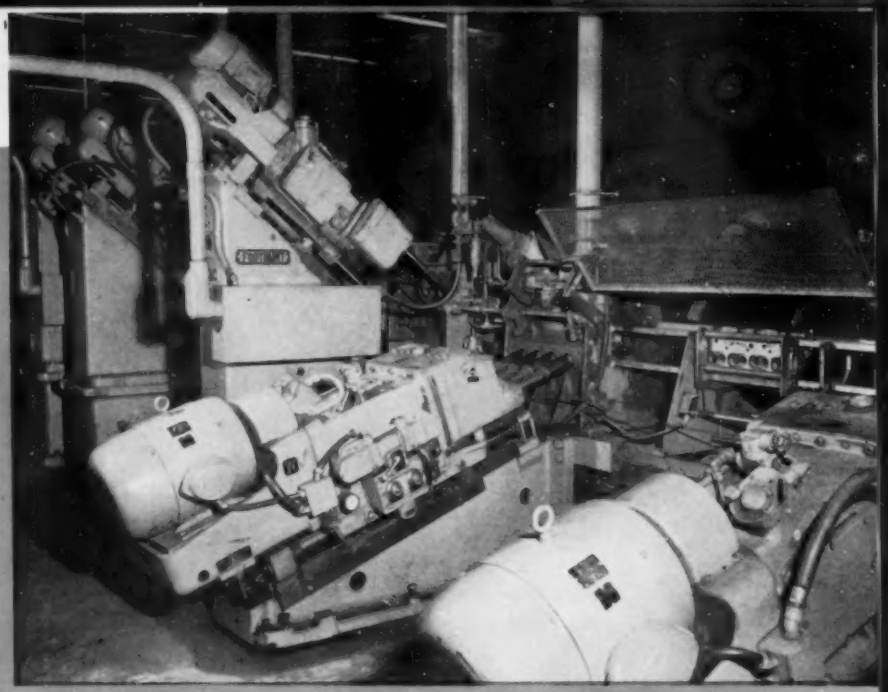
Limit switches have been removed from direct contact with parts in process by the interposition of mechanical actuators. This avoids damage to the switches or contamination by oil and metal chips.

Photographic highlights are presented herewith.



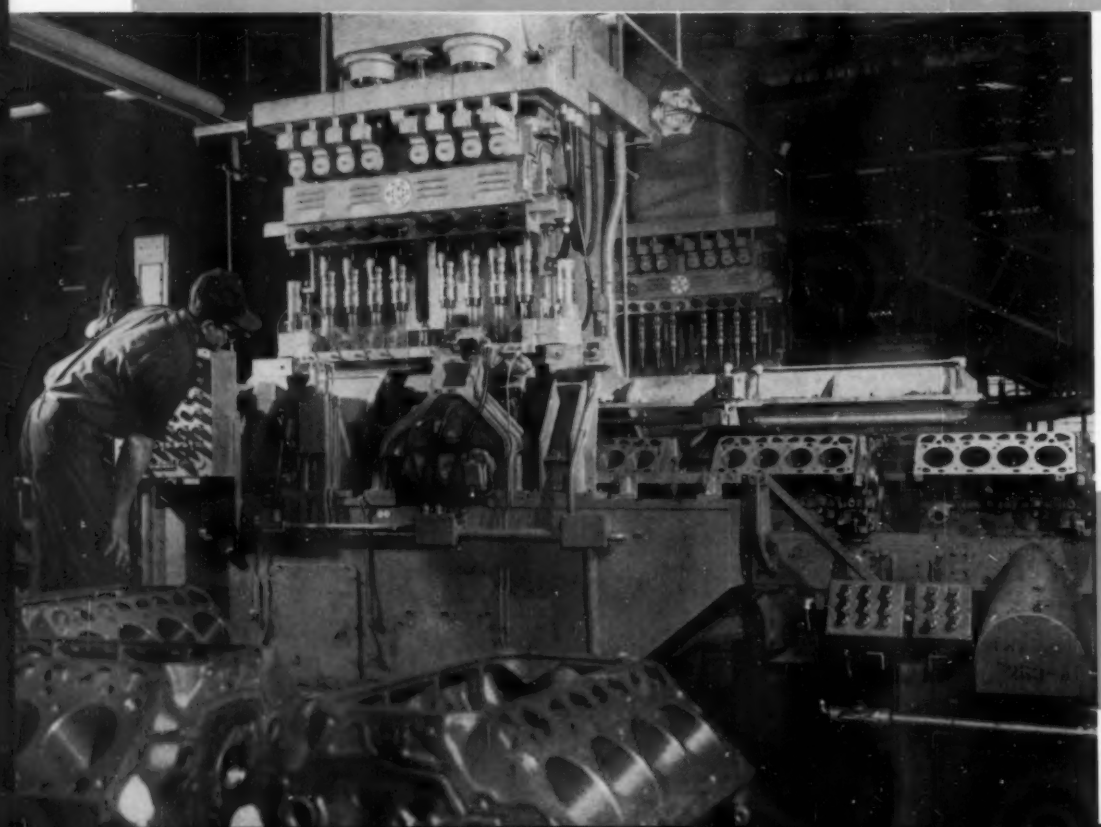
TYPICAL OF THE MAJOR TRANSFER TYPE machine tools is this 17-head unit which drills, chamfers and finish reams holes in cylinder blocks as they advance automatically from one station to the next. The block is a 90-deg V-design, so the drilling heads on either side conform to this angle. Tools are the carbide insert type, the grade selected in accordance with JIC standards. Down the center are exhaust ducts at each station which remove fine cast-iron dust. Heavier chips fall to a scrap conveyor below.

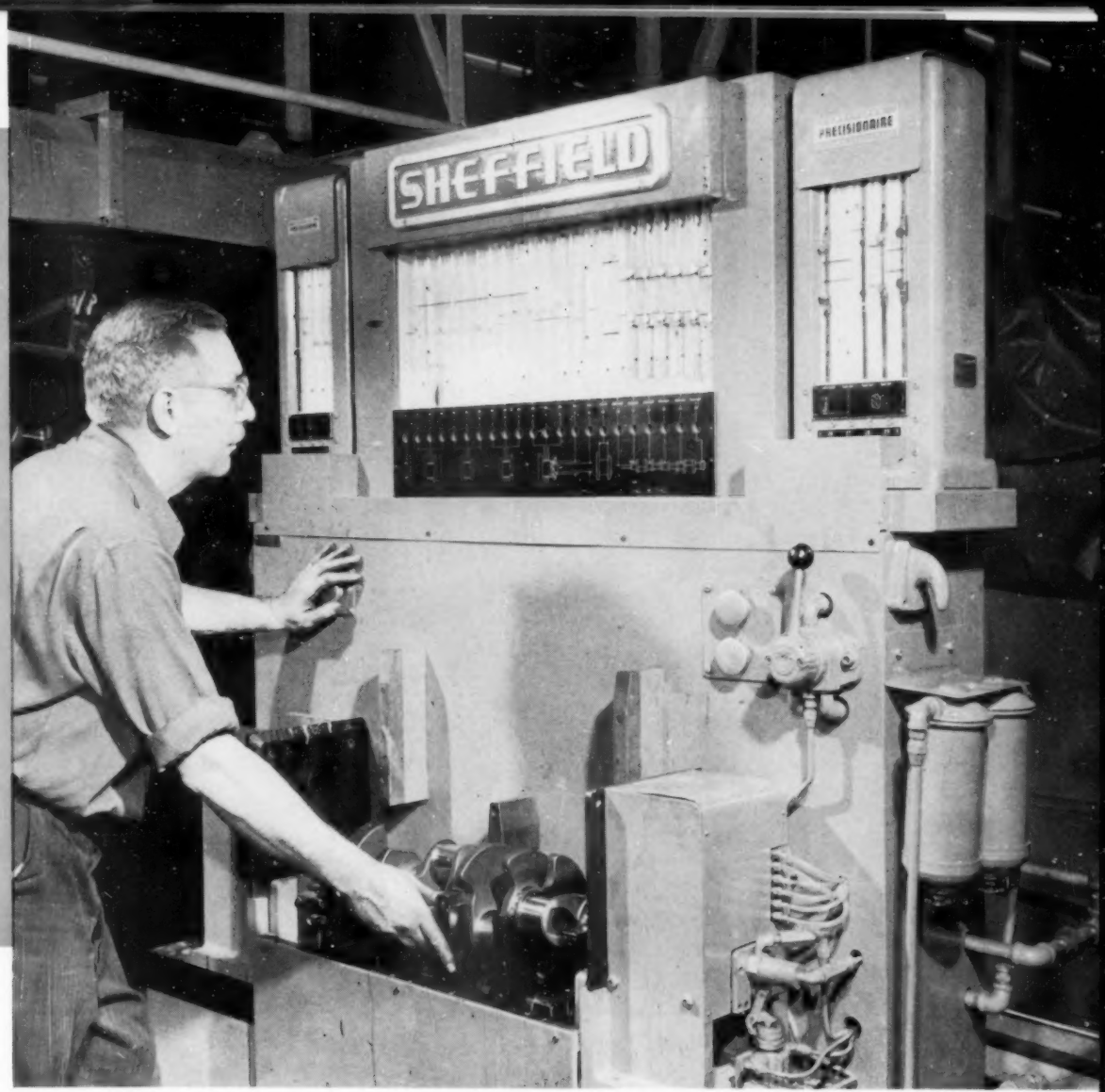




THIS IS A SMALL SECTION of another transfer type drilling machine which handles 107 different operations on a V-8 cylinder head. Drilling units are mounted at different angles on pedestals so that the tools meet the part at the proper angle, avoiding the necessity for repositioning the work.

AUTOMATIC HONING of cylinder bores is carried out in these two-station machines. Blocks are gripped in fixtures which, through hydraulic actuation, are tipped first in one direction and then in the other, to bring the bores in each bank squarely under the four honing tools. The tools are designed so that as each bore is gradually honed out to specified diameter, rotation and reciprocation will stop automatically through a system of electrical contacts within the tools.





COMPLEX AIR GAGING DEVICE simultaneously and automatically checks 64 critical dimentions of a finished crankshaft. The shaft is rotated slowly while air gage nozzles under constant pressure contact the points to be gaged. The pressure loss at the nozzle through escaping air determines the position of small bobs in glass tubes on the face of the gage. These must come within certain specified limits on the gage tubes for a shaft to be approved for subsequent installation. Otherwise it must be reworked. A chart on the gage tells the operator at a glance the exact location of each gaging point, helping him to identify off-limit dimensions and to mark the shaft accordingly.

TOOLS at work

TOOLS at work

PREVENTIVE MAINTENANCE has become a key factor in the operation of large transfer machines, leading to the development of tool control boards such as this. In addition to holding replacement tools, the boards clock the number of cycles of tools or tool groups in operation. When the figure nears the average life per grind, pointers moved into a red or danger area on the dials and the tools are replaced, whether worn excessively or not. Thus, at all times there is a visual indication of the used and unused life of every tool, and machine down time can be kept at a minimum.

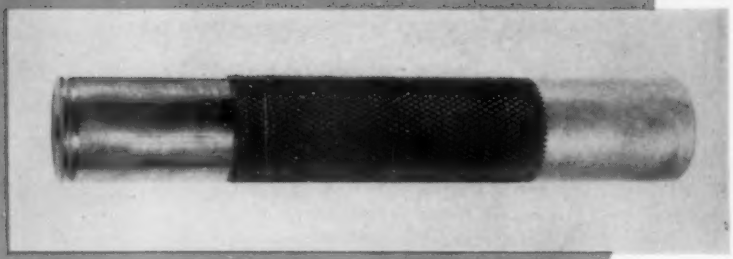


Fig. 1. Experimental plug of "unlimited length," with a pilot and aligning groove, does not stick when the left end enters a hole with only 0.0002-inch clearance, while the untreated right end of the plug sticks badly. Pilot and body diameters are equal.

how to design nonsticking plugs and rings

By Lawrence E. Doyle*

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Material presented by the author in this article represents a report on basic tool engineering research. No attempt has been made to mention practical applications, but work is being done along such lines. The reader can undoubtedly picture guide pins, gages, quick-change toolholders and similar instances of mating plugs and rings.

When a plug is inserted in a close fitting hole or a ring is placed over a plug, the two members tend to stick when first engaged. Investigation into the causes and prevention of such sticking has recently been concluded. This investigation resulted in a series of formulas for the design of nonsticking plugs and rings. Practical application, *Fig.* 1, of the formulas is made possible through the use of the appended nomograms. Correct use of the formulas and nomograms will be outlined through use of illustrative examples, but no attempt will be made to indicate derivations.

When a piecepart is placed on a plug, which is attached to a faceplate, *Fig.* 2, sticking will not occur if the plug is short enough. However, to minimize wear, the plug should be as long as

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possible. Sticking will not occur if the length of the plug is:

$$l = \sqrt{2\,(2a + d)\,(D - d)} \cong \sqrt{2WC} \ldots\ldots (1)$$

where

a = shortest distance from hole to outside edge of workpiece, inches
C = clearance between plug and hole, $D - d$, inch
D = diameter of hole, inches
d = diameter of plug, inches
l = length of straight portion of plug, inch
W = outside diameter of workpiece concentric with hole, $2a + D$, inches

If a 6-inch diameter workpiece has a hole 0.003 inch larger than a locating plug over which it is to be placed, what should be the length of the plug to prevent sticking? In accordance with Equation 1, the length of the straight portion of the plug should be:

$$l = 2\,(6)\,(0.0003) = 0.060 \text{ inch}$$

Solution of this problem is shown on Nomogram 1, which can be used for quick solutions to Equation 1 problems.

If the value for minimum clearance between mating parts is substituted in Equation 1, the length indicated will assure freedom from sticking for the entire tolerance range between the parts but will be short for small clearances. It is usually desirable to make a compromise between zero sticking and long plug life. Longer plugs, with more wearing surface, can be achieved by inserting the clearance between the median hole and plug in Equation 1. Holes larger than the median will not stick and only slight sticking should be experienced with the smaller holes.

If, in the preceding example, it is assumed that the hole has a plus tolerance of 0.001 inch, the tolerance for the median hole would be +0.0005.

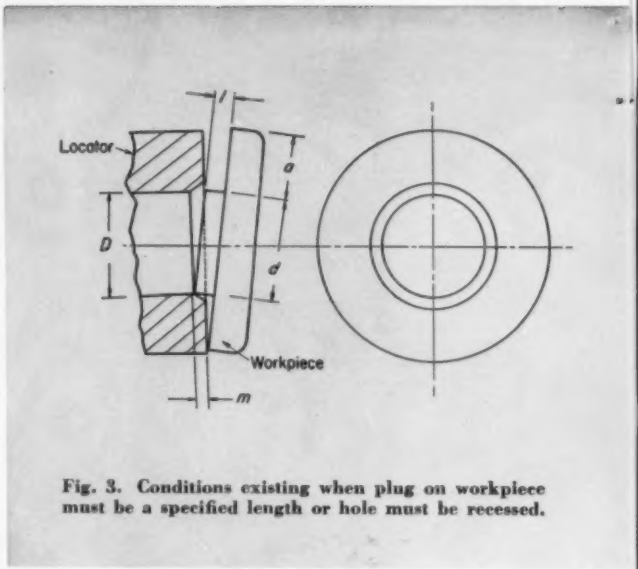


Fig. 3. Conditions existing when plug on workpiece must be a specified length or hole must be recessed.

This value added to the minimum clearance, 0.0003, would result in an assumed value for clearance of 0.0008. The modified plug length would then be:

$$l_m = \sqrt{2\,(6)\,(0.0008)} = 0.098 \text{ inch}$$

Plug length would thus be increased by over 63 percent.

A corollary situation to the foregoing exists when the hole in which the plug is inserted has a countersink or recess at its end. This may occur when the hole in the workpiece must be countersunk or relieved. Also, when a plug must be of prescribed length and is on the workpiece, the locator must be relieved to limit engagement and prevent sticking, *Fig.* 3. In these instances, the length of engagement between the plug and hole is equal to the inserted length of plug less the depth of recess.

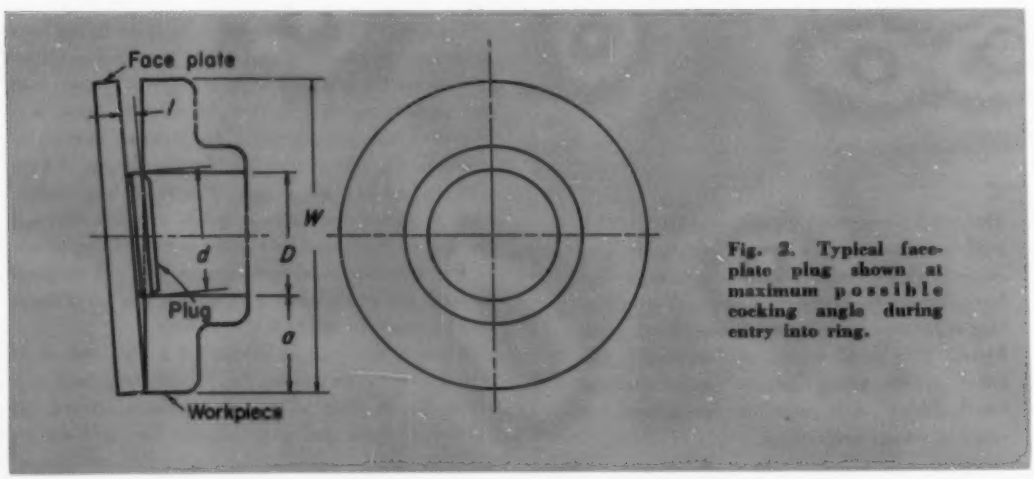


Fig. 2. Typical faceplate plug shown at maximum possible cocking angle during entry into ring.

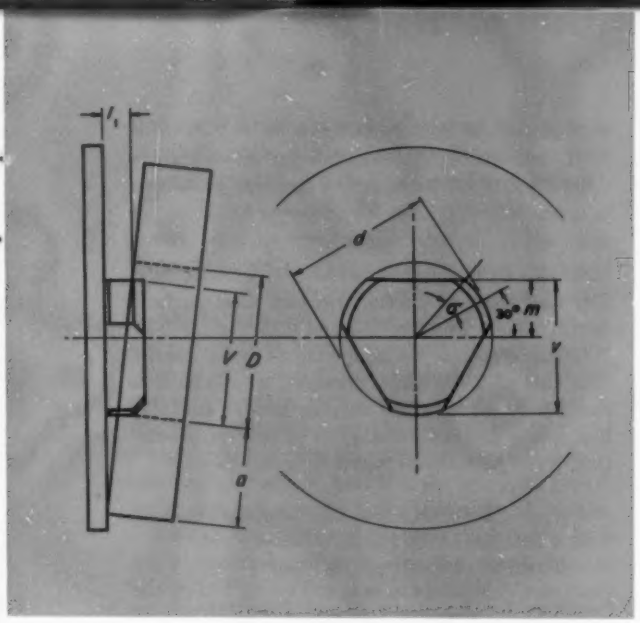


Fig. 4. When faceplate mounted plug is relieved as shown, it can be made longer without tendency of sticking but with a loss of locating accuracy.

To avoid sticking under any conditions:

$$E \leqq \sqrt{WC} \quad \ldots\ldots (2)$$

where

C = clearance between plug and hole, $D - d$, inch
E = length of engagement between plug and hole, $l - m$, inch
l = length of straight portion of plug, inch
m = depth of recess, inch
W = outside diameter of workpiece concentric with plug, $2a + d$, inches

If a 6-inch diameter workpiece has a ¼-inch long plug to be located in a hole with 0.0003 inch clearance, what relief is required in the hole to prevent sticking? It should be considered that the workpiece will be brought to rest against the face of the locator.

$$E = \sqrt{6\ (0.0003)} = 0.043 \text{ inch}$$

Solution of this example is shown on Nomogram 2, which can be used for quick solutions to Equation 2 problems.

With an allowable length of engagement of no more than 0.043 inch and a plug length of 0.250, the depth of recess must be 0.207 inch.

Since Equation 2 is a limiting condition rather than an exact formula, its use must be interpreted. The longer the length of a plug, for conditions shown in *Fig.* 3, the shorter is the allowable engagement length to prevent sticking. On the other hand, for short plugs, the permissable engagement length increases up to an amount equal to:

$$E_{max} = \sqrt{2WC} = 1.4\sqrt{WC} \quad \ldots\ldots (2a)$$

Equations 2 and 2a indicate that where the plug length is fixed, the permissible length of engagement in a hole lies somewhere between $\sqrt{WC}$ and $1.4\sqrt{WC}$, depending on plug length.

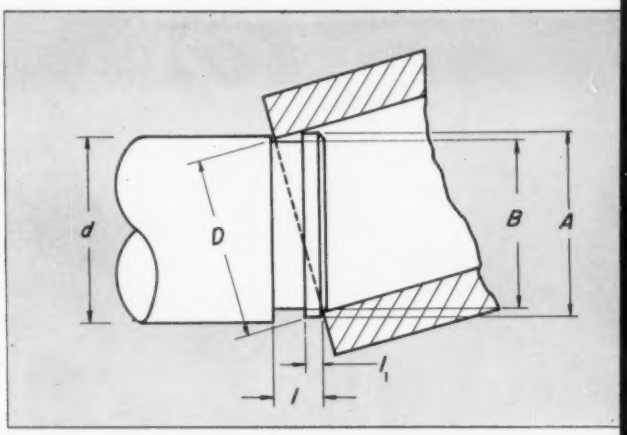


Fig. 5. For plugs of unlimited length, pilots and aligning grooves are used to prevent sticking.

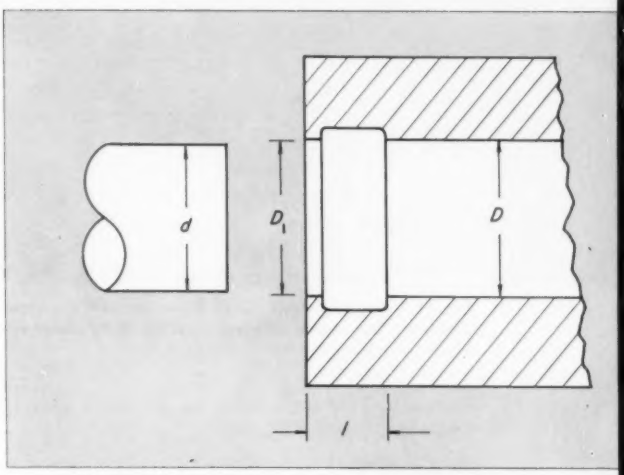


Fig. 6. Unlimited length plugs can be introduced into holes without sticking if a pilot diameter and groove are formed in the ring.

Another method of reducing the tendency for workpieces to stick on a locating plug extending from a faceplate is to relieve the locating plug by cutting away three equidistant segments, *Fig.* 4. A good value for angle σ is 15 deg, which results in:

$$m = 0.35\ d \quad \ldots\ldots (3)$$

The length to which such a cutaway plug can be made without sticking is:

$$l_1 = 2.4\ (2a + 0.85d)\ (D - d) \quad \ldots\ldots (4)$$

This straight length is only slightly greater than that for a full plug designed in accordance with Equation 1.

A disadvantage of relieved locating plugs is that the workpiece can be displaced more in any of three directions than it can on a full plug of the same

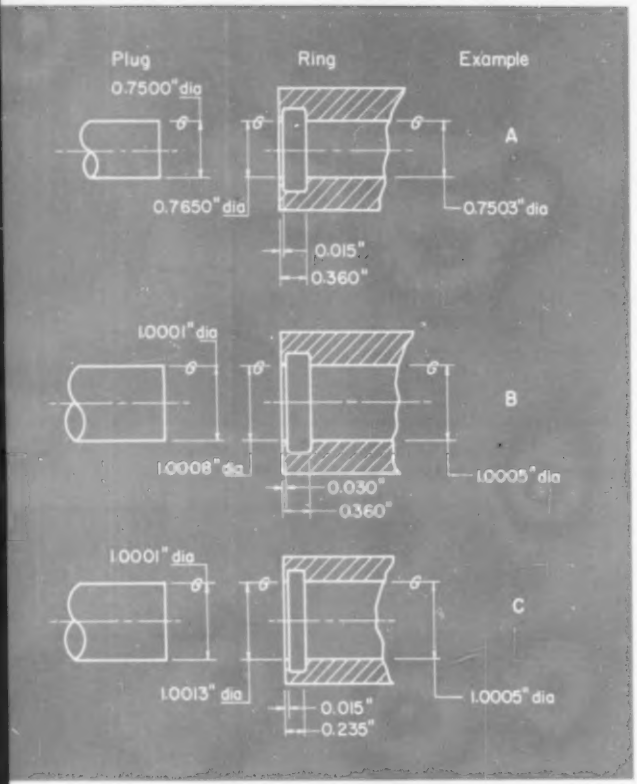


Fig. 7. Experimental rings have proved that pilot diameter has more influence on sticking than does groove length.

diameter. This extra error, as compared to a full plug, is:

$$F = 0.207\ (D - d) = 0.207C \quad \ldots\ldots\ldots\ldots (5)$$

These figures indicate that only a slight length advantage can be gained through use of a cutaway plug while a 20 percent loss in locating accuracy results.

When a plug of unlimited length must be ininserted in a hole, an aligning groove is frequently machined on the end of the plug, *Fig.* 5. Workable dimensions for such design are:

$$l_1 = \sqrt{2AC_2} \quad \ldots\ldots\ldots\ldots (6)$$
$$l = \mu d \quad \ldots\ldots\ldots\ldots (7)$$
$$B = 0.95d \quad \ldots\ldots\ldots\ldots (8)$$

where

A = diameter of the pilot on the end of the plug, inches

C_2 = clearance between plug pilot and hole, $D - A$, inch

l = straight length from pilot chamfer to plug body, inches

l_1 = straight length of pilot, inches

μ = coefficient of friction between plug and hole surfaces

Pilot diameter on the end of an unlimited length plug may be as large as and is commonly made to the same size as the body of the plug. The pilot diameter may be as small as:

$$A = \frac{2d^2}{D} - d$$

Clearance C_2 is equal to clearance C when $A = d$. The coefficient of friction between steel surfaces usually ranges between 0.15 and 0.25.

If a 1.9997-inch diameter plug is to be inserted in a hole of 2.0000 inch diameter, what would be the characteristics of an aligning groove and pilot that would prevent sticking? For ease of production, it can be assumed that $A = d$ and then:

$$l_1 = \sqrt{2(1.9997)\ (0.0003)} = 0.0344 \text{ inch}$$
$$l = 0.15\ (1.9997) = 0.30 \text{ inch}$$
$$B = 0.95\ (1.9997) = 1.90 \text{ inch}$$

Solutions for Equations 6 and 7 are shown on Nomograms 3 and 4.

When it is not feasible to put an aligning groove on a plug, the mating hole may be altered to alleviate sticking when the plug is inserted. A simple alteration is achieved by forming a groove near the entrance of the hole and leaving a pilot diameter, *Fig.* 6. Dimension of the pilot diameter is critical and it must be of a size to provide sufficient clearance for the entering plug to prevent sticking. The required clearance, which must increase with an increase in the coefficient of friction, the plug diameter or both, is:

$$C_2 = (D_1 - d) = d(\sec \tau - 1) \quad \ldots\ldots\ldots\ldots (9)$$

where

C_2 = clearance between plug and pilot diameter, inch

τ = angle of friction between plug and hole surface, degrees

The angle of friction is related to the coefficient of friction through the expression: $\mu = \tan \tau$.

The combined length of the pilot diameter and the groove can be found from the expression:

$$l = \frac{\mu d(D_1 - D)}{2(D - d)} \quad \ldots\ldots\ldots\ldots (10)$$

Solutions to Equations 9 and 10 can be expedited through use of Nomograms 5 and 6.

If a 1.0000-inch diameter plug is to be inserted in a 1.0005-inch diameter hole, what should the dimensions of the hole entrance be to prevent sticking? The coefficient of friction is assumed to be 0.15. The pilot diameter should be larger than the plug by:

$$C_2 = 1.0000\ (1.011 - 1) = 0.011 \text{ inch}$$

The pilot diameter should therefore be 1.011 inches. To avoid all sticking, length of pilot plus groove should be:

$$l = \frac{0.15\ (1)\ (1.011 - 1.0005)}{2\ (1.0005 - 1.0000)} = 1.58 \text{ inches}$$

Such a groove would obviously not be practical and illustrates the shortcomings of this method of preventing sticking for plugs of unlimited length. Normally, to prevent all sticking, the internal groove must be longer than desired. It has been found, however, that somewhat shorter grooves can be used. With shorter grooves, some sticking should be anticipated. One method of shortening the groove is to assume a lower value for the coefficient of friction than is likely to occur. In the previous example, for instance, if the coefficient of friction had been assumed to be 0.05, the length of the groove and pilot diameter surface could have been 0.53. It can be seen that the length of groove is directly proportional to the coefficient of friction.

Several experimental grooved rings have been made of hardened steel with the dimensions as shown in *Fig.* 7. The ring of example A was made with a pilot diameter to satisfy a coefficient of friction of 0.20. The length of 0.360 corresponds to a coefficient of friction of 0.02. The plug shows no tendency to stick in the pilot diameter, but does stick slightly as it enters the body diameter. The amount of sticking would probably not be objectionable in practical usage.

Pilot diameters for rings B and C were designed to be suitable for coefficients of friction of 0.04 and 0.05 respectively. Grooves in these rings were made sufficiently long to prevent sticking even with high-friction materials. Rings B and C resulted in almost as much sticking as if no aligning provisions had been made.

These experimental results indicate that the pilot diameter is more critical than the length of the groove. In other words, the pilot diameter should be calculated on the basis of an adequate coefficient of friction but inadequate coefficients can be assumed during the design of groove length. If the pilot diameter is sufficiently large, the main purpose of the groove, within reasonable limits, is to provide clearance between the pilot diameter and the body of the hole.

Since the pilot diameter must be relatively large in proportion to the diameter of the hole, the aligning groove must necessarily take up a substantial part of the hole. This may impair the hole as a locating device. To overcome this deficiency, two other methods for altering the hole have been developed.

If a ring with a basic hole diameter of D is recessed at the end as in *Fig.* 8, the recess leaves a segment of the body hole diameter, extending through an angle, φ, at the end of the hole. The distance from the hole diameter to the side of the recess should provide the same clearance as that provided by Equation 6. Also, the length of the recess parallel to the axis of the hole should be:

$$l_1 = l_2 = \frac{l}{2} = \mu d \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (11)$$

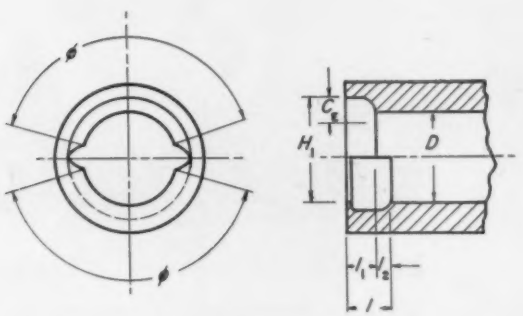


Fig. 8. Example of recessed hole for reducing groove length while maintaining nonsticking characteristics.

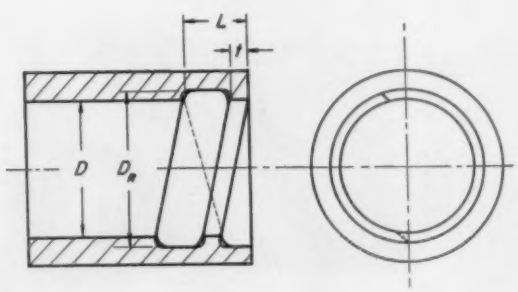


Fig. 9. Helical groove of 1½ turns prevents sticking with small reduction in length of body-diameter size hole.

A value of about 150 deg has been found satisfactory for φ when using hardened steel plugs and rings.

If a ring such as the one in *Fig.* 8 is to be designed with a 1.000-inch diameter hole to take a plug of 0.9996-inch diameter, what should the principal dimensions be? Coefficient of friction can be assumed as 0.15.

The clearance, C_E, equals 0.011 inch, as illustrated on Nomogram 5. The depth of recess, l_1, is about equal to 0.15 inch, as can be determined from Nomogram 4.

Another method of ring alteration is shown in *Fig.* 9. This design of nonsticking ring has a 1½ turn helical groove of lead L, minimum root diameter D_R and width equal to $L - t$. A safe approximation for the lead is:

$$L = 2.5\ \mu d = 2.5\ l \qquad (12)$$

The value for l can be obtained from Nomogram 4.

Root diameter may be:

$$D_R = 1.04\ D \qquad (13)$$

and an average value for thread thickness is:

$$t = \frac{L}{3} \qquad (14)$$

If a helically grooved ring is to be designed to have a 1.000-inch diameter hole and the coefficient of friction is assumed to be 0.15, what would its entrance end dimensions be? The lead would be:

$$L = 2.5\ (0.15)\ (1.000) = 0.375 \text{ inch}$$

and

$$D_R = 1.04\ (1.000) = 1.04 \text{ inch}$$

$$t = \frac{0.375}{3} = 0.13 \text{ inch}$$

Experimental rings with recessed and helically grooved entrances, *Fig.* 10, have proved quite successful in tests. These experimental rings can take plugs with clearances ranging between 0.0001 and 0.0002 inch without signs of sticking.

Now that basic engineering research has resulted in a sound approach to problems of sticking rings and plugs, practical applications of this information to tool engineering problems will soon follow. Opportunities for use of these formulas are numerous and a fund of development and use information should soon build up.

Acknowledgment: This article is based on the same research work as that covered more fully in the University of Illinois Experimental Station Bulletin No. 433, "A Design for Non-Sticking Plug and Ring Gages, and Locators" by Lawrence E. Doyle, Bernard R. Better and Bei Tse Chao. Derivations of and experimental evidence supporting the formulas are contained in the bulletin, available from The Engineering Experiment Station, University of Illinois, Urbana, Ill.

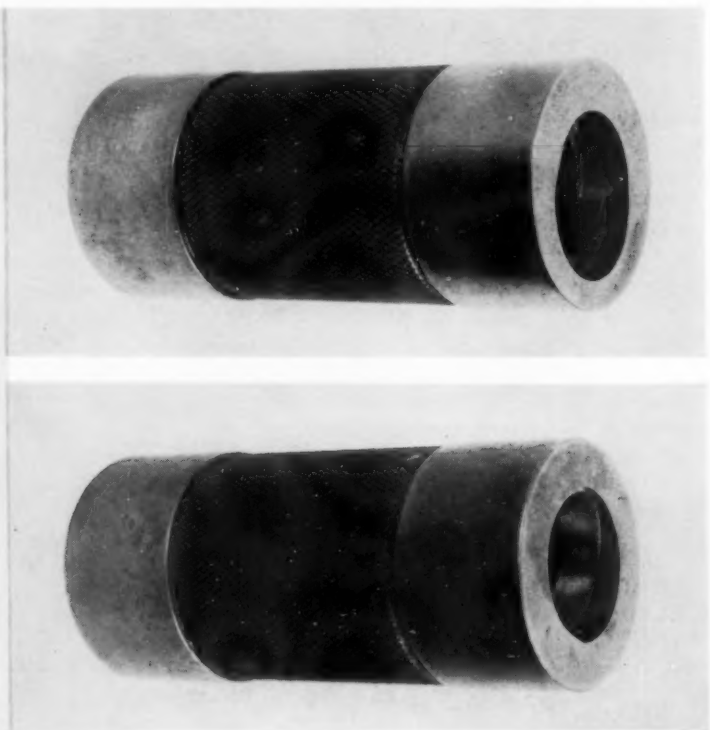
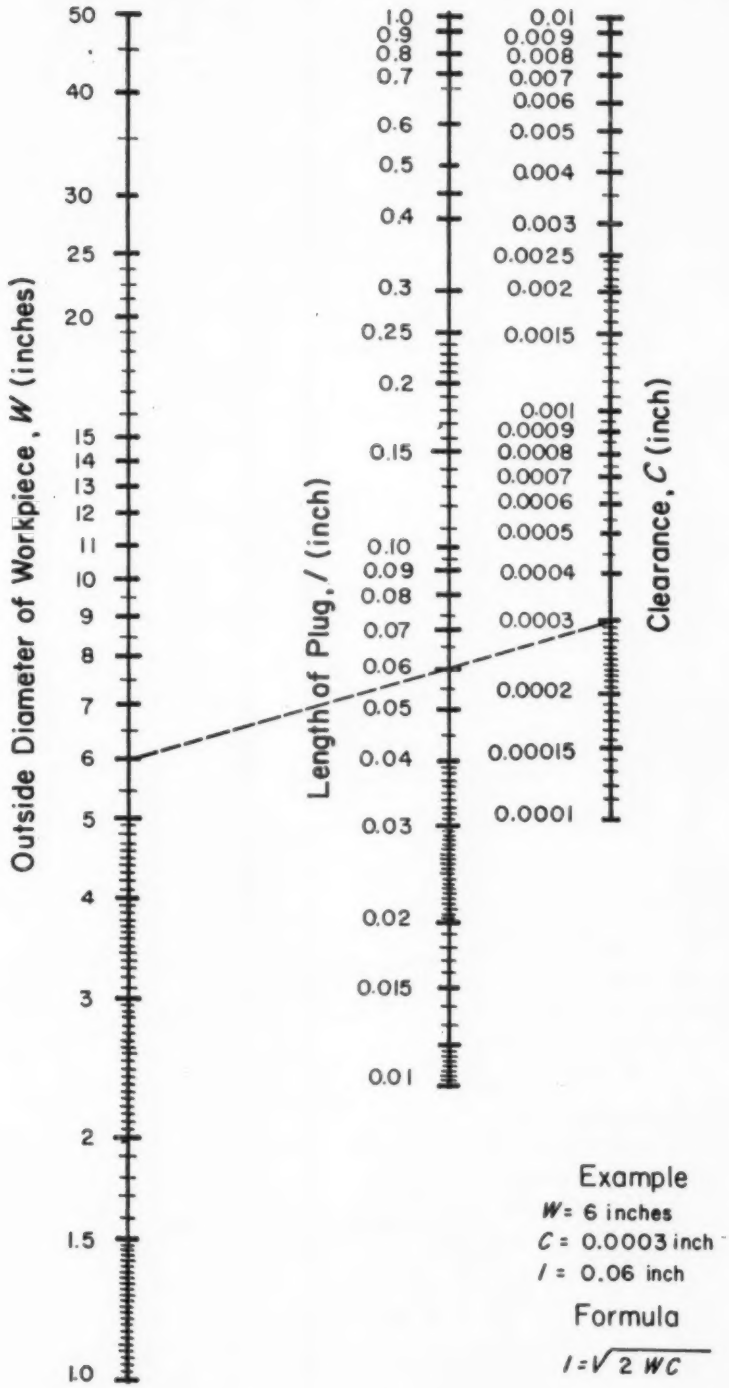


Fig. 10. Experimental rings with recessed end, top, and helical groove, bottom, prevent sticking with little loss of effective hole length.

Nomogram I - Nonsticking Length for Faceplate Plugs



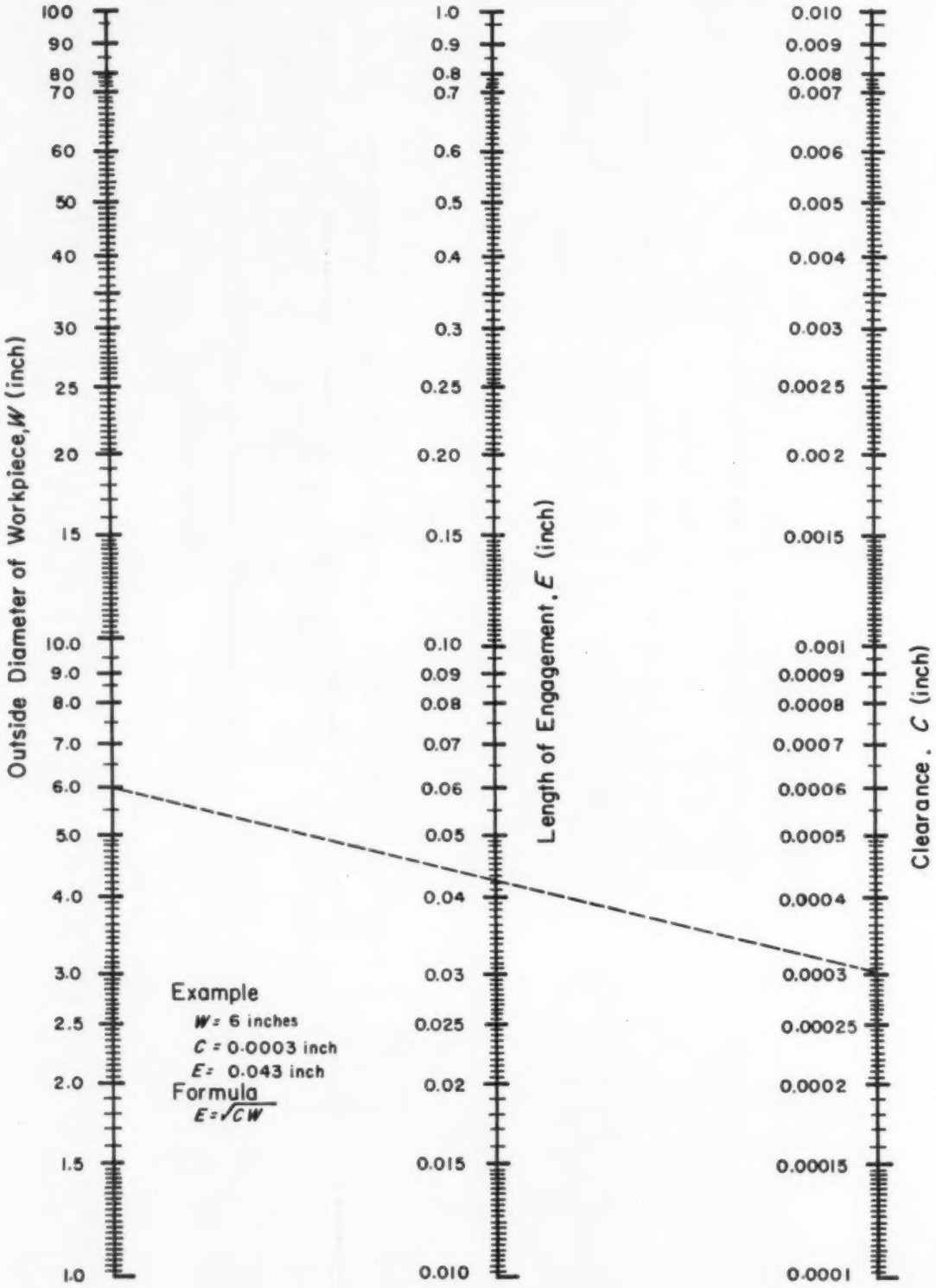
Example

W = 6 inches
C = 0.0003 inch
l = 0.06 inch

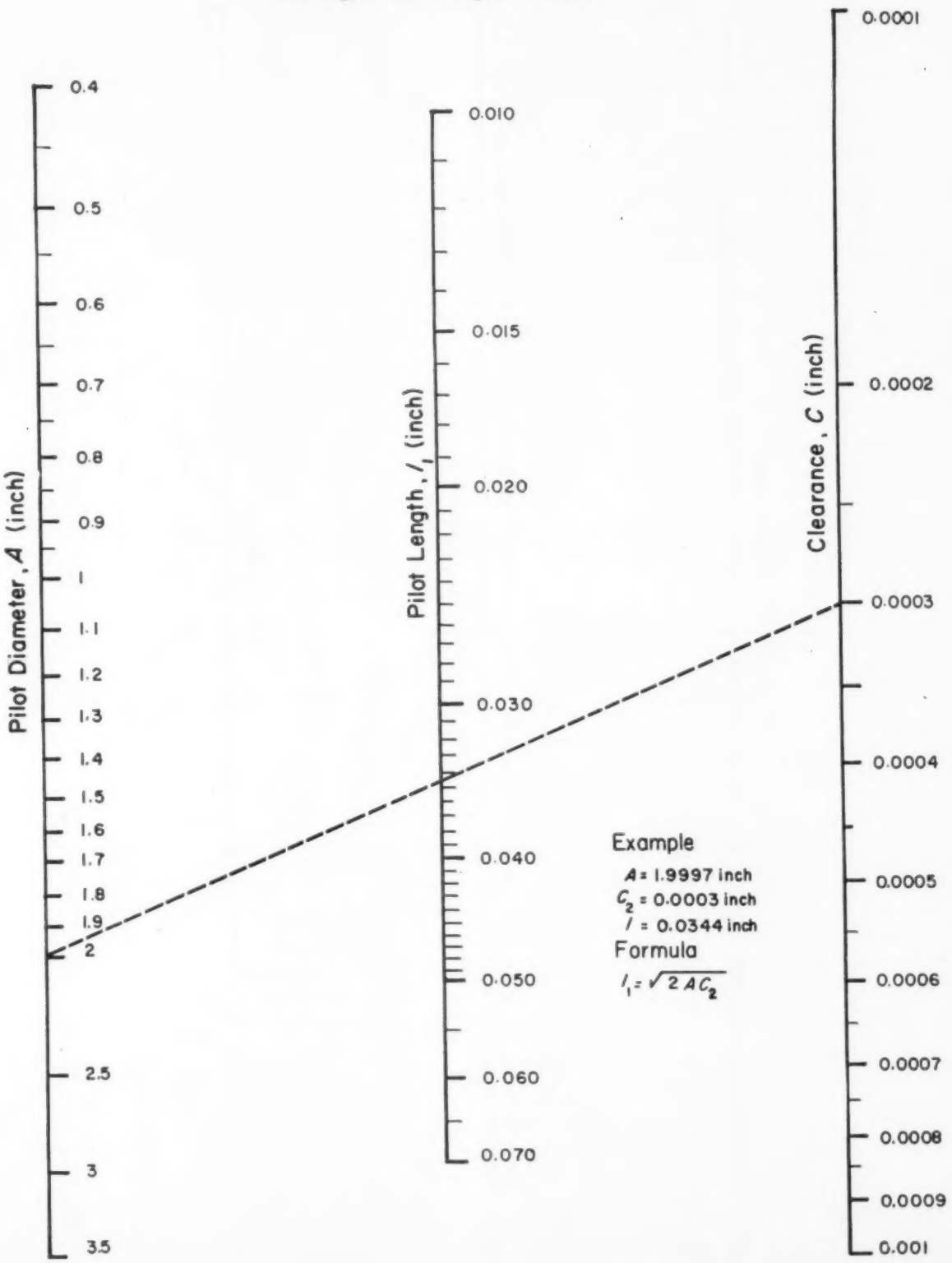
Formula

$$l = \sqrt{2WC}$$

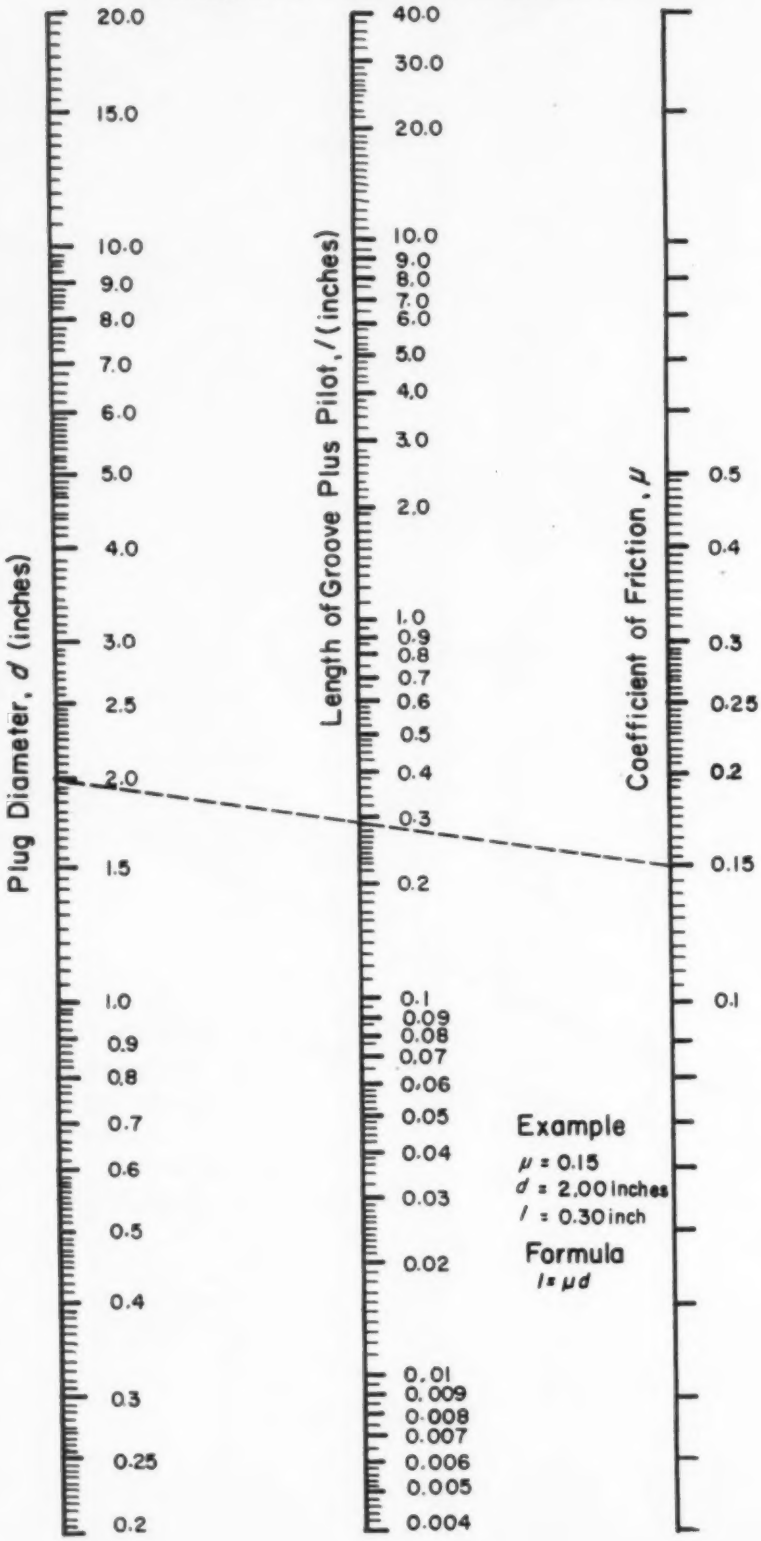
Nomogram 2 - Length of Engagement in Relieved Locating Hole



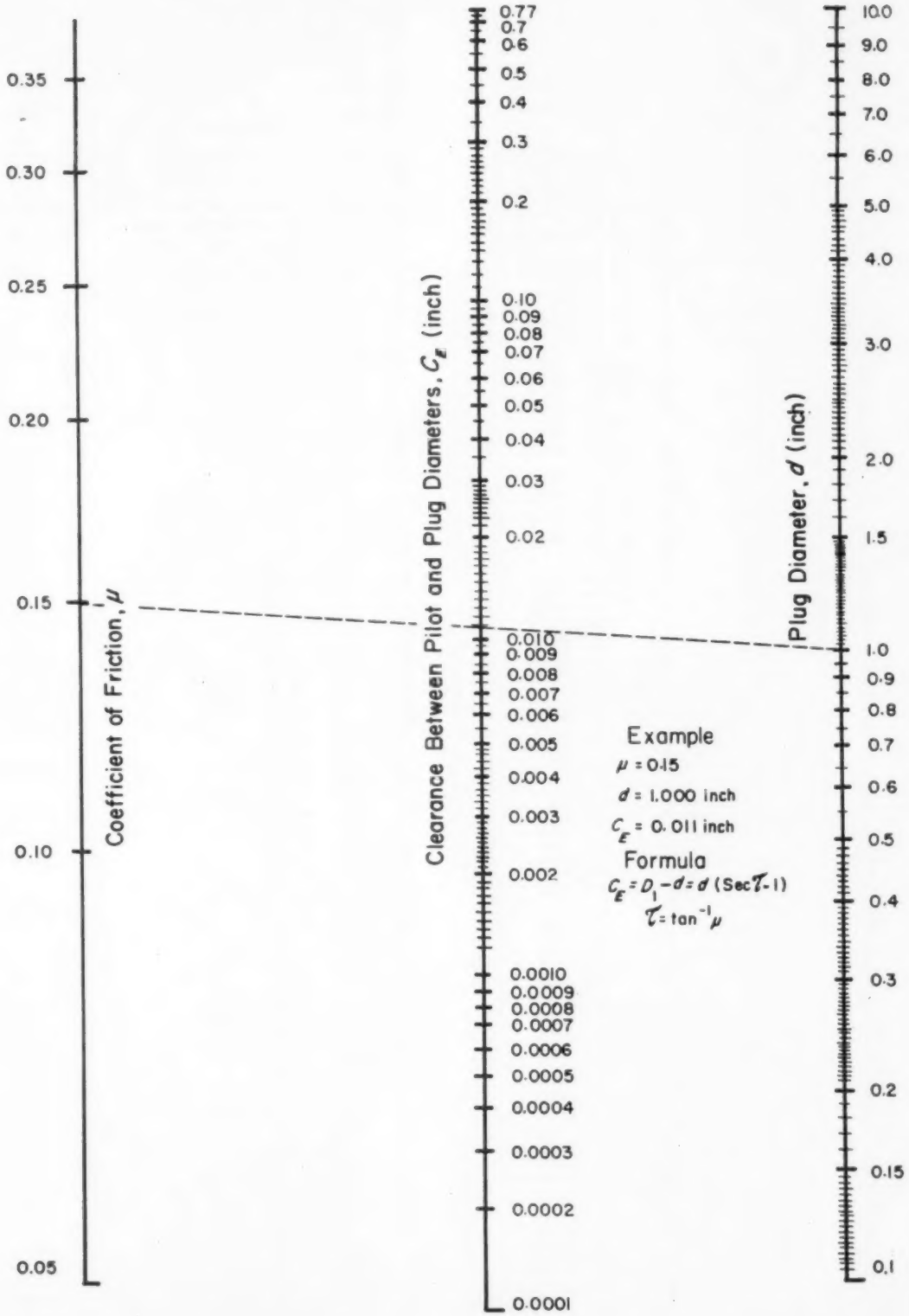
Nomogram 3 - Length of Pilot



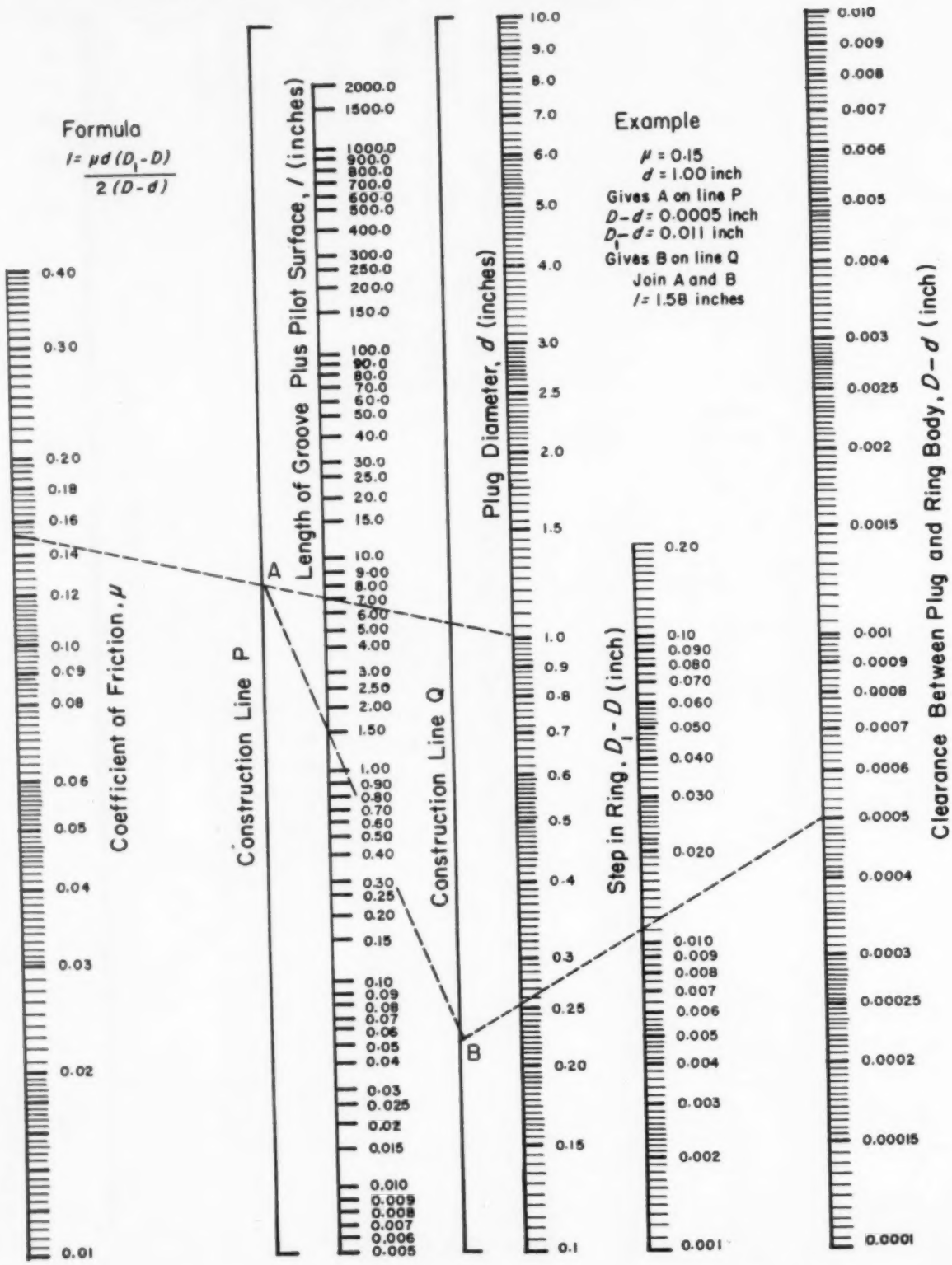
Nomogram 4- Length of Groove Plus Pilot



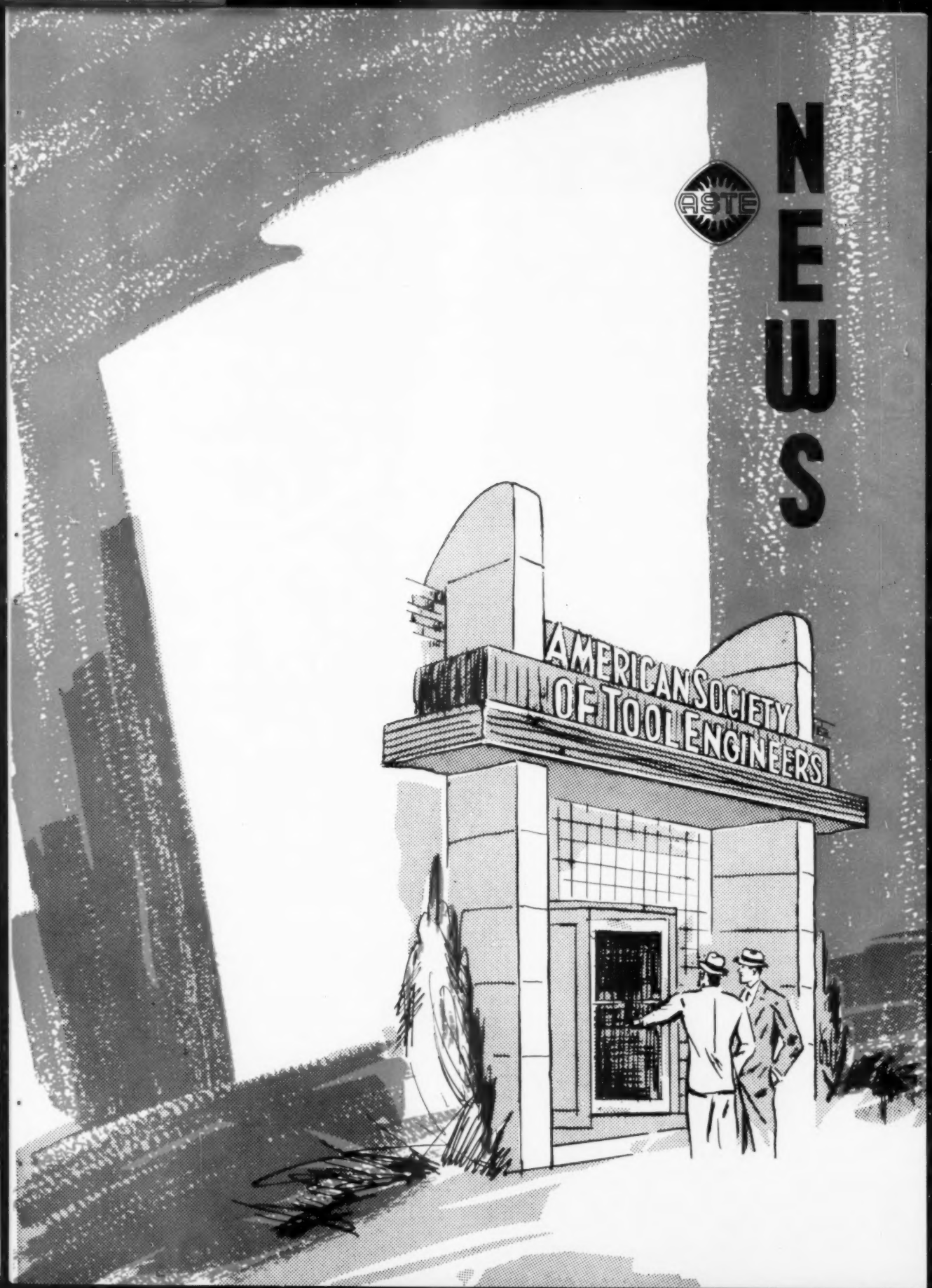
Nomogram 5- Pilot Diameter of Ring Groove



Nomogram 6 - Length of Groove Plus Pilot Surface


Formula
$l = \frac{\mu d (D_1 - D)}{2(D - d)}$
Example
μ = 0.15
d = 1.00 inch
Gives A on line P
$D - d$ = 0.0005 inch
$D_1 - d$ = 0.011 inch
Gives B on line Q
Join A and B
l = 1.58 inches
Coefficient of Friction, μ
Construction Line P
Length of Groove Plus Pilot Surface, l (inches)
Construction Line Q
Plug Diameter, d (inches)
Step in Ring, $D_1 - D$ (inch)
Clearance Between Plug and Ring Body, $D - d$ (inch)
A
B

NEWS



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ARTHUR G. METCALFE holds a B. A. degree from Queens College and a Ph. D. from Cambridge University in England. A member of several technical societies, he has served in industry as a research physicist and research metallurgist. Joining Armour Research Foundation of Illinois Institute of Technology in 1953 as senior metallurgist, he is currently conducting research on failure of aircraft components, electrical connectors, powder and fiber metallurgy.

MILTON C. SHAW, a professor of mechanical engineering and head of the Machine Tool Division, Massachusetts Institute of Technology, received his undergraduate training at Drexel Institute of Technology and a Sc. D. degree in chemistry and physics at the University of Cincinnati. In addition to work in the research laboratories of Cincinnati Milling Machine Co., he was chief of the Materials Branch of the National Advisory Committee.

PRESCOTT A. SMITH was graduated from Massachusetts Institute of Technology with a B. S. degree in mechanical engineering and has worked in industry ten years as equipment engineer, methods engineer, plant engineer, tool engineer and factory manager. Associate professor of mechanical engineering in charge of the machine tool laboratory at Massachusetts Institute of Technology, he is also a past member of the ASTE National Education Committee and past chairman of the Boston ASTE chapter.

JACK T. WELCH, general manager of the Machine Tool Division of Sheffield Corp. for the past six years, received his degree from General Motors Institute of Technology and carried postgraduate work at Massachusetts Institute of Technology. For the past two years he has spent much of his time on the development and research of the Sheffield Cavitron, process of ultrasonic machining. Having traveled extensively in Europe the past five years, he made a comprehensive study of manufacturing and marketing conditions.

ASTE

Convention

Technical Papers Previewed

A number of the papers slated for presentation at the 1956 convention in Chicago are previewed here to give advance information to readers of THE TOOL ENGINEER. Additional paper previews will appear in the March issue.

In his paper, "Cemented Borides for Tool Materials," A. G. Metcalfe, senior metallurgist, Armour Research Foundation, describes work that has been done on a research project investigating the suitability of borides as tool materials. Sponsored by the ASTE Research Fund Committee, this project has a two-fold goal: development of a material based on borides suitable for replacing cemented carbides in the event of restricted supplies of tungsten; and determination of the suitability of cemented borides as tool materials. Mr. Metcalfe covers the initial phases of the program including selection of borides for investigation and methods for preparation of samples.

Since it is well known that finish can be improved and tool life extended if friction forces that act on faces of tools can be reduced by use of a boundary lubricant, the ASTE Research Fund has also sponsored a project aimed at determining the best way of applying the lubricant. "Methods of Applying Cutting Fluids" by M. C. Shaw and P. A. Smith,

Smith

Daugherty

Trecker

Constance

NORMAN R. SMITH holds British patents on many inventions for the diamond tool industry and has been active in standardizing diamond tool specifications in Britain. A graduate of Cambridge University, he was appointed this past year to the Board of Directors of L. M. Van Moppes & Sons (Diamond Tools), Ltd., with which he has been affiliated since 1929. He visited Johannesburg in 1955 to study diamond mining techniques at the Premier and Kimberly mines.

JESSE DAUGHERTY, a graduate of the Ohio Mechanics Institute, also studied mechanical engineering at University of Cincinnati. He has served as manager of Hypro engineering and consultant on Hypro products for Giddings and Lewis Machine Tool Co. He was an active force in the development of profile machines for the aircraft industry and promoted the development of the Giddings & Lewis "Numericord" system of machine control.

FRANCIS J. TRECKER, president of Kearney & Trecker Corp., is a graduate of Cornell University with a B. S. degree in mechanical engineering and administrative engineering. A member of many technical and civic organizations, he served two years in Washington as Expert Consultant to the Secretary of War on Subcontracting and Facilities Procurement. He also directed many defense activities for the War Production Board.

JOHN D. CONSTANCE, a registered professional engineer in New York and New Jersey, attended New York University where he received a B. S. degree in chemical engineering. Associated with M. W. Kellogg Co. in chemical and oil refinery design, he has spent the past 13 years helping his fellow engineers obtain legal recognition through the medium of his professional guidance consulting service, home study aids which he has authored and published, and as an instructor in refresher courses.

professor and associate professor of mechanical engineering, respectively, at the Massachusetts Institute of Technology, presents a progress report on the work to date.

The history, the equipment, present applications and the future of machining with sound waves is described in the paper "Machining with Silent Sound" by Jack T. Welch, general manager, Machine Tool Division, Sheffield Corp. By using ultrasonic waves and an abrasive slurry, production processes have been developed for indenting both conducting and nonconducting materials through controlled erosion. Describing current applications of the process, the author includes the sinking of forms in carbide, the slicing and dicing of germanium, the cutting of synthetic jewels for bearings and related uses.

Preparation of industrial diamonds for use as tools has pretty much followed the practices laid down by the preparation of gem stones. This was an obvious course since it was in this field that experience has been gained. However, in his paper "Some Aspects of the Batch Production of Shaped Diamond Tools," N. R. Smith, director of L. M. Van Moppes & Sons, Ltd., states that as experience was gained in the use of diamonds as tools, changes inevitably took place in their production. With the adaptation of equipment and the introduction of new techniques, it has been not only feasible but more practical to prepare diamond tools in batches rather than in single units. The diamond tool industry has arrived at the point where standard tools are now available.

"The Tool Engineer's Function in Numerical Control" by Jesse Daugherty, consultant on Hypro products for Giddings & Lewis Machine Tool Co., describes the methods whereby computer procedures are being applied to production processes. The author points out that in the future the program engineer will be intimately connected with and, in fact, dominate the function of material specification, methods planning, tool and fixture design, time and motion programming, computer techniques, manufacturing cycles and personnel. His influence must be dominant in machine purchase and must feed back strongly in product design and parts specification. Net result of the successful application of numerical control will be better products produced in larger quantities at less expense.

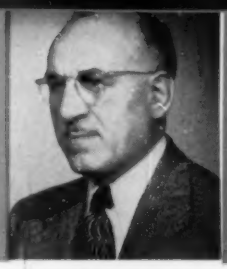
Since the producers of machine tools must change their methods to meet changing production requirements, it was probably just a matter of time and a coalition of circumstances that saw the introduction of machine tool leasing programs. Francis J. Trecker, president, Kearney & Trecker Corp., describes one approach to this marketing method in "Economics of Replacing Machine Tools by Equipment Rental."

"How To Become a Registered Professional Engineer" by John D. Constance of the M. W. Kellogg Co., generalizes the steps by which an individual can become a registered professional engineer. Generalities and examples have had to be used because the registration laws of the various states differ. Since there is talk of restricting use of the word "engineer" it is considered advantageous for all individuals currently functioning under that title to understand the requirements for registration.

L. A. Hurwitz and R. A. Kurtz of the Science Laboratories Dept., Hamilton Watch Co., have prepared a paper on "The Use of Diamond Tools for the Turning and Shaping of Small Parts." This paper describes in detail the types of diamond tools used and the results obtained in making the many precise parts of fine timepieces. Accuracy and surface finish are important to watch parts and dia-

Hurwitz

Kurtz



Martin

Stone

LEON A. HURWITZ, with a M. S. degree in chemistry from Pennsylvania State College, is chief metallurgist for the Hamilton Watch Co. In addition to holding this position, he has been head of Hamilton's Science Laboratories Department and responsible for metallurgy, chemistry, crystallography, physics, electronics and optics. A registered professional engineer in Pennsylvania, he is affiliated with many technical societies.

R. A. KURTZ was graduated from Franklin and Marshall College with a B. S. degree in chemistry. Employed at Hamilton Watch Co. since 1948 to the present, he is chemist and crystallographer. He is a member of the Southeastern Pennsylvania section of American Chemical Society, having served on the local section's public relations committee in 1953 and 1954.

CHARLES L. McCABE who has published in the fields of radiochemistry, catalysis, high temperature thermodynamics and high temperature kinetics, has been assistant professor in the Department of Metallurgical Engineering, Carnegie Institute of Technology, since 1951. Previously an instructor in chemistry at Harvard University, Dr. McCabe obtained his B. S. degree in chemistry at Dickinson College and his Sc. D. in chemistry at Carnegie Institute.

ALFRED V. BODINE, president and treasurer of the Bodine Corp., which he organized in 1933, completed his technical education at Lehigh University where he was graduated with a degree in mechanical engineering and later had an honorary degree of Doctor of Engineering conferred upon him in recognition of his outstanding leadership in his professional work and in the civic life of his community. Holding official capacity in a long list of civic and technical organizations, Mr. Bodine is a member of the Connecticut State Development Commission and was recently elected vice president of the state's Development Credit Corporation.

LOUIS D. MARTIN, first chairman of the Fine Pitch Gearing Committee of the American Gear Association and under whose leadership all of present American Standards for fine pitch gear were developed, has been awarded 22 patents covering gear checking and cutting equipment and photographic apparatus. Completing his 30th year as gear engineer and consultant with Eastman Kodak Co., he is the author of 35 articles on gearing.

J. JAMES STONE, JR., previously a development engineer at Oak Ridge National Laboratory where he developed an analog computer for the study of the control of nuclear power reactors, is now assistant chief of Electrical Engineering Division, Battelle Memorial Institute. Holding memberships in several technical societies, he has a B. S. degree in electrical engineering from Virginia Polytechnic Institute and a M. S. in electronics from Harvard.

McCabe

Bodine

mond tools have helped raise the quality while reducing the number of operations.

Instrument gears, those of 20 diametrical pitch and finer, are vastly diversified and represent a distinct area in the field of gearing. In "An Objective Look at the Field of Instrument Gearing," Louis D. Martin, gear consultant for Eastman Kodak Co., calls on 40 years of experience to trace the history of instrument gears before and since they became a special branch. Gearing materials, gear production methods and design approaches to gear trends are summarized in this paper. Special attention is accorded to spiroid gears, and the author points out that the degree of engineering required for gear sets costing $200,000 apiece and gears costing $3 per thousand is very much the same.

Serving as an introduction to the broadening field of computing devices and computer control machines, the paper "Introducing Computers for Machine Tool Control" by J. J. Stone, Jr., assistant chief of Electrical Engineering Div., Battelle Memorial Institute, very carefully describes the differences between digital and analog computers through examples and by comparisons.

"Cemented Diamond Particle Tools and Wheels, and Their Application to the Dressing of Grinding Wheels" by Dr. C. L. McCabe, assistant professor at Carnegie Institute of Technology and consultant to the Koebel Diamond Tool Co., shows how diamond powder has been applied to the dressing of grinding wheels to exacting requirements. This method of taking advantage of the hardness of diamond materials will not replace existing methods of using diamonds but will rather augment them. This represents a comparatively new technique but sufficient progress has already been made so that the process should be investigated by production engineers who are responsible for grinding processes.

Close tolerances are expensive; excessively close tolerances are ruinous. Such is the theme of the paper "Impact of High Accuracy Low-Tolerance Requirements on Jigs and Fixtures in Mass Production" by A. D. Bodine, president and treasurer of Bodine Corp.

In many instances, close tolerances are necessary and the purchaser of the product is willing to pay for these tolerances because of the better service achieved. However, it must be realized that the tolerances on jigs, fixtures, gages and cutting tools must be even closer than those specified for the parts they are to produce and check. Mr. Bodine proposes a system for periodically reviewing tolerances and changing them when experience indicates they can or should be changed.

It's 8:05 pm and time to get underway. The gavel of Chairman Richard T. Fitzgibbons signals the opening of another Mid-Hudson executive meeting

EXECUTIVE COMMITTEES PAY OFF!

Mid-Hudson chapter in Poughkeepsie, N. Y. lists advantages enjoyed through full scale use of executive committee plan

Nancy M. Houston
News Editor

Success in ASTE chapter operation is dependent on many factors and one of the most important, chapter officials agree, is the full utilization of the executive committee. While not an absolute 'must' in the Constitution and By-Laws, use of the chapter executive committee plan is strongly urged and has become standard operating procedure for nearly all of ASTE's 130 chapters and all of the chartered student groups.

Advantages of the plan are many and varied, as members of the Mid-Hudson chapter in Poughkeepsie, N. Y. have known for some time.

Chartered in November of 1946, the chapter has nearly ten years of ASTE experience to its credit. This experience has provided ample proof to the members of the soundness in employing the executive committee plan of operation.

Starting with the major reason for the existence of the American Society of Tool Engineers—that of increasing scientific knowledge in the wide field encompassed by the tool engineering profession—the executive committee plan makes possible better technical meetings.

More time can be devoted to lectures and educational discussion for the benefit of the entire membership, since most of the business affairs are lifted out of the chapter meeting and delegated to the executive committee. This makes for more generally interesting chapter sessions and cuts down on the boredom that might be experienced by the tool engineer with only a member's responsibility and no committee or official concern.

In the long run, more interesting meetings build better attendance. No longer does the more casual member have to anticipate a business session which may run as long as an hour before the

photographs by Raymon P. Traver

Brief cases in hand, this group of chapter leaders enters the Nelson House Hotel, scene of many technical meetings and executive sessions. Picture, from left, are: Henry J. Tesmer, Micheal N. Hall, Vincent J. Cavalieri and Richard T. Fitzgibbons

A beaming elevator operator is happily surprised by the photographer who snaps J. Harry Keller, left, second vice chairman, and Warren G. Watkins, head of the membership committee, as they approach their meeting room

meeting gets around to the real meat of the program, the technical lecture.

Then too, there's more time available for becoming better acquainted with other members. Certainly few tool engineers could quarrel with the opinion that the informal exchange of shoptalk and new ideas in conversation with other members is important in widening personal knowledge of the new developments in the profession, and in keeping posted on the 'people' side of things—who is doing what, what new positions have been assigned, which companies are planning expansions, and the like.

All this results in a warmer, friendlier chapter, which in turn makes a stronger chapter.

No less important in making a chapter stronger is insuring that it is a well-run chapter, with due and proper attention paid to the many business matters. Here's where the executive committee itself shines.

With the Mid-Hudson chapter, the committee meets once a month, just one week after the chapter meeting. This timing is important. Since it is so soon after the chapter meeting, all details are still fresh and any changes or constructive criticisms can be made with sure knowledge. It is also enough in advance of the next meeting of the chapter to allow plenty of time for effective planning.

As voted by Mid-Hudson when it instituted the executive committee plan, the committee is composed of: chapter officers; chairmen of all committees; the national and alternate delegates; and one or more past chapter chairmen. The balloting to have such a committee was followed by the passing of a resolution delegating to it the proper authority with which to conduct chapter business.

Of course, the chapter membership retains its

Everyone is present so Chairman Fitzgibbons calls the meeting to order. Like most chapters, Mid-Hudson utilizes an expanded executive committee

Named head of the recently established book committee, V. J. Cavalieri, right, receives his new assignment from the chairman

Program Chairman Hall, center, discusses a meeting with Joseph L. Petz, left, chairman, National Editorial Committee, and Frank N. Plotnik, first vice chairman

right to elect officers and vote on referendum questions, as provided in the Constitution and By-Laws. In addition, other business matters are discussed at chapter meetings when the executive committee feels the need for a wider expression of opinion.

Another type of executive committee setup that Mid-Hudson could have selected is one made up of chapter officers only. However, it was and is the chapter consensus that a more effective job can be done with an expanded group. The larger committee also enables the committee chairmen to become more experienced in chapter operation, thus providing better qualified future candidates for elective posts.

Regardless of who is serving on the executive committee, sessions of the group are open to any and all members of the chapter. The casual observer at a typical Mid-Hudson meeting finds a spirit of informal concentration, with a few aside comments and humorous notes to keep the tempo going at an alert pace. Participants are, nevertheless, geared to 'sticking to the point' which assures fairly early adjournment.

No needless 'hurry up' is used, however, just to get activities over with, as is often the case where chapters hold their business sessions in connection with the regular chapter technical meetings. In the latter situation, as chapter officials are speeding things along in order to get to the technical lecture, haphazard decisions and 'skimmed over' matters often result.

Another aid in keeping the meetings rolling along is the advance preparation made by all concerned. Necessary information is noted, reports are written up, required materials grouped together and all is in readiness for discussion and consideration before the sessions open. *continued*

Stanley P. Cook, right, professional engineering chairman, is shown with W. R. Neidhardt, adult education director, Arlington High School

Money matters are the chief responsibility of Treasurer C. Morgan Newbury who keeps the books in such condition that the chapter's financial condition is apparent at a glance

Topics for discussion at the executive sessions range from the latest information published in the "National Delegates' Newscaster" to news of the night classes sponsored by the chapter in cooperation with the department of adult education at Arlington High School.

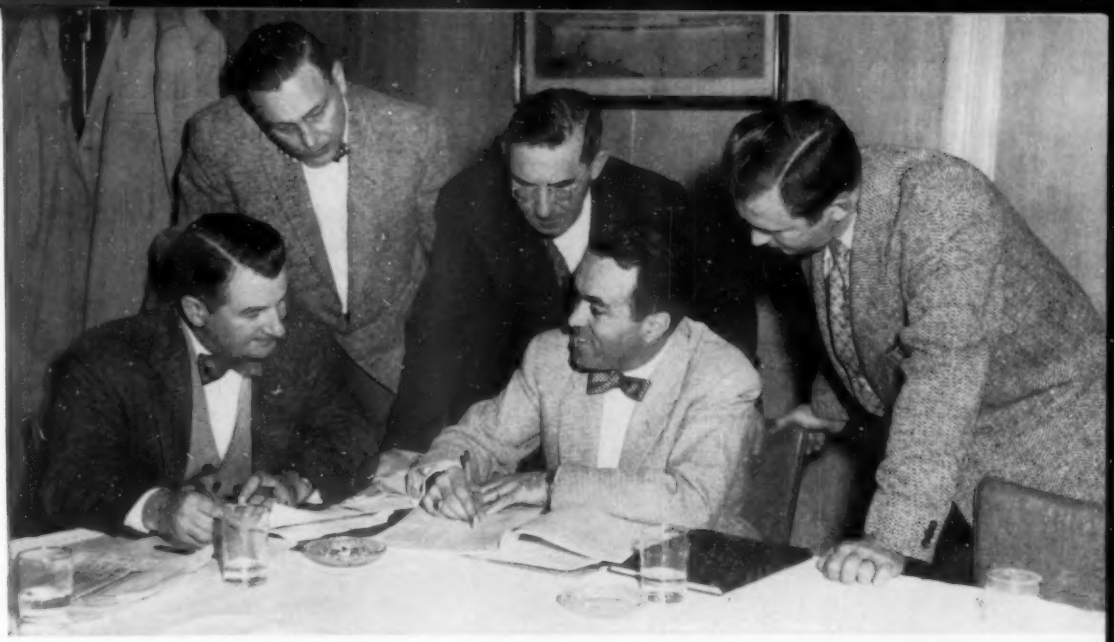
Details of future meetings are announced, applications from prospective members are considered, and the bills for the month are reported, together with the financial status of the chapter. Minutes of the previous meeting are read, approved and/or corrected, and actions of the committee are noted in the current minutes. And of course, a portion of each meeting is thrown open for discussion of new business.

One of the most important actions of the executive committee this past year was the organization of a progress committee, patterned after a committee instituted by ASTE on a national level.

Where the executive committee's major concern is the immediate business at hand, the progress committee assumes its responsibility in the long-range view. It provides continuity of planning from one year to another; is able to study special programs and activities not in the domain of any other chapter group; and in giving excellent help to Mid-Hudson's executive committee, offers additional proof, if any is necessary, that executive committees do "pay off."

Reporting chapter news is the major ASTE activity for Davis Gale, right, who is chairman of the public relations and editorial committees. Mr. Newbury is also pictured here.

A double role is also filled by Henry J. Tesmer, national delegate and chairman of the chapter's education committee



Mid-Hudson instituted a progress committee last year. Probably the first such group in any ASTE chapter, members keep experienced eyes on chapter trends. Pictured here are: Messrs. Plotnik, Watkins, Petz, Newbury and Tesmer. Newberry is committee chairman

National and chapter standards activities are reported at executive sessions by Walter A. Stadtler, Mid-Hudson standards chairman

A nearly silent participant in the proceedings is the watch which ticks off the minutes until 10:15 and the meeting's adjournment

Applications from prospective members are read by Warren G. Watkins, chairman of the membership committee

Lawrence Institute of Technology

Eleventh Student Chapter Chartered

Officers of the Lawrence Institute student chapter look over their newly acquired charter. Seated, from left, are: Fred Ciampa, Chairman Peter Young and Maurice Katzman. Over their shoulders are: Arthur Plinski, National Director C. M. Smillie and Kenneth Julian.

Special guests at the meeting included: seated from left, Father Stanley Krupa who gave the invocation, Carl Abbott, Stanley Commer and Herbert Sanborn. Standing are: Prof. William Dowlding, Prof. C. G. Gergle, Dean Edwin O. Graeffe, Anthony S. Rogers, Dean Hans Erneman and Prof. Robert McKee.

Engineering students at Lawrence Institute of Technology in Detroit were the recipients of the eleventh charter to be granted to a student chapter by ASTE. The charter was presented in ceremonies following a dinner on Nov. 22.

Acting as chartering officer, Charles M. Smillie, one of ASTE's national directors, installed the officers of the chapter and addressed the group on "Where Do We Go from Here?"

Officers of the 42-member chapter are: Peter F. Young, chairman; Fred Ciampa, first vice chairman; Maurice Katzman, second vice chairman; Kenneth Julian, secretary; and Arthur Plinski, treasurer.

Many members of the Detroit chapter who worked diligently to help get the chapter organized, took an active part in the program. Stanley Commer, chairman of the Detroit chapter's education committee, was toastmaster.

In a series of presentations, Carl S. Abbott, chairman of the Detroit chapter, presented the charter plaque; a gavel, gift of the Detroit chapter, was handed over to Chairman Young by Anthony C. Panfil, who is vocational department head at Detroit's Chadsey High School; and Herbert Sanborn, treasurer of the Detroit chapter, presented the chapter allocation check.

Robert E. McKee, chairman of ASTE's National Education Committee and associate professor of production engineering at the University of Michigan, pinned the chapter chairman's emblem on Mr. Young's lapel.

The engineering faculty of Lawrence Institute was well represented by Dean Mordica M. Ryan, Dean Edwin O. Graeffe, Dean Hans Erneman, Prof. William Dowlding and Prof. C. G. Gergle, who is faculty advisor for the group.

Among other guests at the meeting were: Leonard B. Lovings, Detroit first vice chairman; Anthony S. Rodgers, second vice chairman; and Meldrum MacPetrie.

Indiana Chapters Find "Council Plan" Helps Insure Success of Purdue Conferences

ASTE's "Leadership Conference"—the executive training conference held in March, 1953 for all chapter chairmen—is still paying extra dividends for chapters in Indiana.

The Indiana chairmen had met only once before that time, to plan the first annual ASTE-Purdue University Tool Engineers Conference. After having had two days to get acquainted at the Leadership Conference in Detroit, one of them suggested that the Indiana group should get together three or four times a year to plan the next Purdue Conference and also to discuss chapter operations. And so the Indiana Council was established.

Since the geographical center of the state is Indianapolis, it was the choice as the meeting location. A vote proved a preference for Sunday meetings, which are held at an Indianapolis restaurant.

It seemed logical that a man would be more likely to attend meetings if his wife was with him, so the ladies received special invitations. A goodly percentage of the wives accompany their husbands, spending the day as they wish. They've all become well acquainted and instrumental in the success of the ladies' activities at the Purdue Conferences through their organization and planning.

To attend meetings of the Indiana Council, chapter representatives drive an average of 110 miles each (the farthest is 164). Because of the distances and the amount of time involved, the excellent turnouts time after time are especially gratifying.

Since the council was formed, Calumet Area chapter has been chartered, as has the Purdue University student chapter which also cooperates in conference sponsorship. Louisville chapter in Kentucky asked to participate and was admitted to the council. Added to the original five chapters—Evansville, Fort Wayne, Indianapolis, Muncie, Richmond, South Bend—these newcomers make a total of nine groups active in the organization.

Naturally, before the first meeting of the council, there was a question as to how well they would get along and whether they could agree on program subjects for the conference. It has since been mentioned many times how smoothly the group works together. There is no evidence of inter-chapter rivalry.

The council holds an annual election in which the chairman, first and second vice chairmen, and immediate past chairmen of participating chapters are eligible for nomination. The voting is limited to the same group so that each chapter has an equal chance. It is the usual procedure to elect the chairman and secretary-treasurer from the same chapter for simplicity and efficiency.

An attempt is made to pass these jobs around among the chapters, although the ones showing the most interest may receive a lot more consideration. While only those mentioned are eligible to vote, all views are welcomed and considered in the sessions.

That this operation has proven successful is evident in the results of the last three ASTE-Purdue Conferences. Each year the programs have been acclaimed top-notch, and the attendance has been exceptional. It has been surprising, and most gratifying, to see just how many men are willing to spend so much of their own time and money to promote their local, state and national ASTE organization.

Feb. 15 Is Deadline for Applying for Scholarships

Less than a month remains for fourth and fifth year students in tool engineering, mechanical engineering, production engineering, and industrial engineering to apply for ASTE's 1956 International Education Awards.

Feb. 15 is the last date applications can be accepted by the National Education Committee, ASTE National Headquarters, 10700 Puritan Ave., Detroit 38, Mich.

A total of ten awards of $700 each are being sponsored for students who show interest and aptitude in such subjects as: metal processing; plant layout; tool design; inspection and quality control; and manufacturing processes. Applications are available at engineering schools and ASTE National Headquarters.

LONG BEACH—It looks like a party—and it was! Dec. 3 was the date, Lakewood Country Club the place and the occasion was the sixth annual dinner dance. More than 160 members and guests turned out for the event.—*Jack Irby*

KALAMAZOO—Ladies' night was held in December, with about 80 members and wives taking part in the festivities. A variety program was staged for the occasion by television station WKZO. Pictured at the party, from left, are: Mrs. C. A. Elzinga, Chairman and Mrs. Glen Rue, Mr. and Mrs. Ralph Seigel, and Dr. and Mrs. Don Nance.

BINGHAMTON—The Vestal American Legion Hall was the scene of the Binghamton chapter's annual Christmas party on Dec. 7. Following a turkey dinner, members and wives enjoyed dancing. It was announced that Philip Taylor, present chairman, and Jack Pangburn, past chairman, had been transferred to the IBM plant in San Jose, Calif. The chairman post will be taken over by Wendell Harper, first vice chairman.—*Glyn Williams*

E. J. Weller Addresses Calumet Area Members

A program on the "Carboloy Machinability Computer" was presented Dec. 12 at a meeting of the Calumet Area chapter. Speaking to a group of 65 members and guests was E. J. Weller, carbide design and application engineer, Carboloy Dept. of General Electric Co.

With the aid of slides, Mr. Weller explained the complexities of the computer and described the vast amount of research and development which preceded its manufacture.

Selection of the nominating committee was made at this meeting, with C. H. Zacher named as chairman. Among the guests present were Frank Rozek of Indianapolis and Edward Dickett of Rockford. —*J. W. Montgomery*

Roy Hedberg Becomes Registered Engineer

Second vice chairman and a charter member of the Kalamazoo ASTE chapter, Roy Hedberg received his certificate of professional registration in Michigan at ceremonies held in the Rackham Bldg., Detroit, on Nov. 5. A tool engineer at Clarage Fan Co. of Kalamazoo, he is also co-owner of Professional Design Service of Battle Creek. Mr. Hedberg is chairman of the Kalamazoo chapter's book committee as well as a member of the Kalamazoo Engineering Society and the Michigan Society of Professional Engineers.

Be Sure to Vote!

Early in February all voting members of the Society will be receiving a referendum ballot on the proposed revision of the ASTE Constitution. The revision is the result of years of work and study by several National Constitution and By-Laws Committees.

It has been approved by the ASTE Board of Directors for referendum ballot, and by the chapter constitution and by-laws committees. Now it is in hands of the Society membership. Each and every member of ASTE is urged to examine carefully the proposed revision and exercise his right and privilege to vote. A period of a month has been allowed for return of the ballots which must be postmarked no later than March 5. *Be sure to vote!*

BOSTON—Special guests and officers are shown at the executive night meeting held in November. Front row: Francis J. Sehn, chairman of the ASTE National Book Committee; John X. Ryneska, national secretary; Dr. Harry B. Osborn, Jr., national president of the Society; Charles L. Sadon, Boston chapter chairman; and Wilfred B. Wells, chairman of the National Public Relations Committee. Back row: Ken Riddle, dean of Drexel Institute; George C. Bennett, member of the National Public Relations Committee; and Karl G. Nowak, member of the National Program Committee.

"Plastics in Tooling" Topic of Nebraska Speaker

Meeting at the Lincoln Hotel, about 40 Nebraska members and guests heard a discussion on "Plastics as Used in Tooling" at their December meeting. Guest speaker was George M. Rice, sales manager for Renaud Plastics, Inc., Lansing, Mich. Using slides for illustration, he introduced a type of tooling that was unfamiliar to many in the group.

A tour of the Falstaff Brewing Corp. of Omaha was scheduled for members of the Nebraska chapter during November. A group of 52 was guided through the plant and witnessed automation in the brewing industry. Seventeen master mechanics were on hand from the Continental Can Co.

A nominating committee was elected and includes: Adolph Schpatz, chairman; Henry L. Rossi; Robert J. Wilfring; and John Cernelic.

—Dean W. Roper

Ladies Honored at Battle Creek Meeting

Holding their first ladies' night program, members of Battle Creek chapter were hosts to about 35 guests at their Dec. 12 meeting. Addressing the ASTE audience was James P. Erdman, coordinator for the Grand Rapids Furniture Makers Guild. His topic was "Furniture Today." A dance followed the dinner meeting.

One item of business on the agenda was selection of the nominating committee. *—Arthur F. Damon*

President Harry Osborn Addresses Boston's Executive Night Meeting

Dr. Harry B. Osborn, Jr., national president of the Society, was the featured speaker at Boston chapter's executive night meeting, held Nov. 3 at New England Mutual Hall. Approximately 200 members and guests attended the program.

"Why Good Tool Engineering Is Important in Your Business" was the subject of Dr. Osborn's talk, which stressed the fact that the social and economic well-being of the nation is closely related to the achievements of engineers and scientists through a continuous "peaceful industrial revolution."

Three scholarships were presented by Boston chapter to outstanding students in the area. Awarded by Charles W. Moody, instructor at Wentworth Institute and chairman of the chapter's education committee, they went to: Norman Mercier of Wentworth Institute; Donald Gaines of Franklin Institute; and Donald Marquis of Northeastern University. These students were selected by the deans of their respective schools because of their high scholastic standings, individual needs and their interest in the profession of tool engineering.

Among the guests at the meeting were: H. Russell Beatty, presidenty of Wentworth Institute; Col. Alden P. Tabor, Ordnance Corps, Watertown Arsenal; and Major John Ford, representing Major General R. C. Maude, commander of the U. S. Air Force Research Center. *—Melvin P. Burns*

Lehigh Valley Members Tour Carpenter Steel

Members and friends of Lehigh Valley chapter, numbering 110, met at the personnel office of The Carpenter Steel Co., Reading, Pa., in preparation for a guided tour through the mills on Nov. 18. They were welcomed by James L. Kissling, chief industrial engineer, and dispatched in groups of ten to view operations which included the initial scrap-yard stage to the storage warehouse, final phase in the entire operation. *—Chauncey R. Kay*

DENVER—"Foreign Tool Engineering and Machine Tools" was the subject discussed by Harold E. Collins, third from right, vice president of ASTE and manager of foreign operations for Hughes Tool Co., Houston, Tex. Mr. Collins' comparison of American and foreign machine tools was followed by an informative question and answer period. Pictured with the speaker, from left, are: F. J. Geoffrey, member of the National Standards Committee; Willard Krieger, national delegate; Clinton Helton, member of the National Membership Committee; Norval Allen, Denver chapter chairman; and George Buckel, vice chairman.—*David S. Proper*

Quality Control Topic at Pennsylvania Meeting

"Quality Control as Related to the Tool Engineer" was the subject of a talk given by Daniel G. Meckley, III, at Central Pennsylvania chapter's Dec. 7 meeting. Mr. Meckley is manager of quality control and inspection at Commercial Division of York Corporation.

David A. Schrom, member of the ASTE National Public Relations Committee, member of the chapter and plant superintendent of York's Commercial Division, brought along as his guests 38 of his supervisors.

The chapter congratulated R. H. Meckley on his appointment to National Committee for the revision of the *Handbook*. Eight new members were introduced to the chapter by Membership Chairman Art Linden, and a group of executives from Brubaker Tool Corp. made a 112-mile drive to attend. Ninety-two were present at this meeting held at Lincoln Woods Inn.

—Paul F. Leese

HARTFORD—The chapter's nineteenth anniversary was commemorated Nov. 7 with a particularly outstanding meeting. Past National President Ray H. Norris, third from left, presented an account of the first 19 years of chapter progress. Laurence D. Miles, fifth from left, manager of value analysis for General Electric Co.'s manufacturing services, spoke on the work of his staff in the company's material and purchasing department. Others present, from left: Paul Dillberg, chapter secretary; Harry Gotta, first vice chairman; J. J. Balciunas, chairman; and Richard A. Smith, national director. A number of guests from neighboring chapters were on hand; the attendance also included 12 past chapter chairmen.

Twin Cities Hear About Multiple Spindle Tooling

A meeting at the Covered Wagon Cafe attracted 130 members and guests of the Twin Cities chapter on Dec. 7. General sales manager of National Acme Co., R. R. Rhodehamel presented a talk and slides on "Multiple Spindle Tooling."

Another highlight of the evening was the introduction of scholarship winners—Joseph Cramsie from St. Paul Vocational School and James Muellner of Dunwoody Institute. *—Roy Wressell*

Extrusion Topic at Milwaukee Meeting

"Extrusions and Extrusion Presses" was the subject of a technical talk given by H. C. Sproule at the Milwaukee chapter's Dec. 8 meeting. Mr. Sproule, district sales engineer of the Cleveland office of Loewy Hydropress, Inc., discussed the suitable metals for extrusion such as steel, aluminum, copper, as well as the possible shapes of extrusion, lubricants, and cost of dies and maintenance.

The audience of 87 at Serb Memorial Hall also saw a color-sound film on actual extrusion of hot and cold metals. Several new members were presented with pins. *—Walter Behrend*

Racine Hears About Plastic Tooling

At one of the best attended meetings of the fall season, 125 members of the Racine chapter met at Dania Hall in Racine to hear a talk on plastic tooling. The speaker was H. B. Heinzen, plastic tool engineer for Federal Machinery Sales. Mr. Heinzen traced the history and development of plastic tooling and showed slides of current practical plastic dies and fixtures.

Following the talk members demonstrated four types of plastic tools and a question and answer period was held by Mr. Heinzen.

On December 9 the chapter held its annual fall dinner dance at the Meadowbrook Town and Country Club. Sixty-five couples attended, dining smorgasbord style and dancing to the music of Glen Jensen. The women received costume jewelry as gifts from the chapter.

—Alvin J. Michna

BALTIMORE—Ladies' night festivities were held early in December at the Engineers' Club, with more than 60 couples participating. Entertainment included a program staged by hypnotist Charles Lockermann. Gifts of hand-painted serving trays were presented to the ladies.—*Raymond T. Crew*

Arthur Oakley Discusses High-Speed Steels

San Antonio members attending the Dec. 14 technical session heard a talk on the use and misuse of tool high-speed steels. Speaker at the meeting was Arthur R. Oakley, Jr., sales metallurgist, Steel and Machine Tool Sales Co., Houston, Texas. Using slides for illustration, Mr. Oakley discussed the five types of tool steels and various hardening processes.

Guests at the session included Lt. Don Cassidy of the United States Air Force and M. Diener of Steel and Machine Tool Sales Co.

—Stanley G. Gower

Gala Christmas Party Held at New Haven

The New Haven Country Club was the scene of a festive Christmas party and ladies' night held by the New Haven chapter on Dec. 13. Turkey dinner and dancing to the music of Bud Finch's orchestra were the major activities for the 165 who attended. A social hour before the party was sponsored by the Gilbert and Richards Co. The arrangements for the event were made by Barry Burr and a diligent committee. —*Silas W. Becroft*

Power Press Automation Topic at Cincinnati

Speaking on "Power Press Automation," Neil Van Deusen addressed members of the Cincinnati chapter on Dec. 13 at Engineering Society Headquarters. Mr. Van Deusen, sales manager of the V & O Press Co., pointed out that with the present-day production rates and with the use of progressive dies, the one avenue open to time saving is in handling. He showed slides to illustrate his points. Dinner and a film preceded the talk.

—*Barton M. Jones, Jr.*

Harry Conn Addresses Niagara District Chapter

"Production Tooling Problems" was the subject of Harry Conn, chief engineer of Scully-Jones and Co., when he addressed members and guests of Niagara District chapter in December. His discussion dealt chiefly with modern tapping methods as used in present day automatic production equipment.

Coffee speaker was Laroche Hudson, vice president of Switson Industries, who told what tool engineering can do for the average small Canadian industry. To illustrate his remarks he exhibited some of his company's dies.

The nominating committee was selected, with Cy Mitchell, Fred Dunn and A. Zavitz named to choose the slate of officers. —*William A. Yaeger*

Fox River Valley Stages Annual Ladies' Night

Members of Fox River Valley chapter were hosts on Dec. 3 for their tenth annual ladies' night. Held at the Baker Hotel in St. Charles, the program included dinner, dancing to the music of Dave Bennett's orchestra, entertainment by the Chapman Dancers, and the presentation of prizes to the guests. About 75 couples attended the event.

—*H. L. Smith*

TRI-CITIES—Mrs. Nathan Jingst takes home a prize from the chapter's annual Christmas party which was held at the American Legion Hall and attended by 320. The presentations were made by, from left: James Rosborough, treasurer, and Albert VandeWalle, secretary.

—*Don Shewry*

Dayton Holds Christmas Dance

Dinner and dancing were the main items of interest when 118 couples gathered at Miami Valley Golf Course for Dayton chapter's annual Christmas dance on Dec. 17.

Heralded as a huge success, the dance was in the capable hands of Warren Braun and his committee, who were voted thanks for their untiring efforts in planning the social event.

—*Robert Bleicher*

Greater New York Holds First Ladies' Night

In conjunction with its regular monthly meeting, Greater New York chapter held its first ladies' night on Dec. 5. Approximately 175 attended the event at the New York Times Bldg.

Special guests at the meeting were Howard C. McMillen, national vice president of ASTE, and James O. Horne, one of ASTE's national directors. They directed their talks especially to the ladies to acquaint them with the important contributions their husbands are making in industry and emphasized the benefits of ASTE membership.

Main speaker was C. M. Binney, district manager of Allegheny Ludlum Steel Corp., who discussed and showed a movie on the influence of stainless steel on the home, transportation and industry.

A light touch rounded out the evening when Albert and Josephine Butler of the Albert Butler School of Dancing in New York City, put on an exhibition of various social dances. All joined in trying out a new ballroom novelty, the Cha-Cha-Cha.

—*Jean Nazeley*

Appointment Announced

Ralph P. Sharp has been named district manager of Union Twist Drill Co.'s San Francisco branch, according to an announcement by John C. Molinar, vice president in charge of sales. Mr. Sharp is a member of the Golden Gate chapter.

GRANITE STATE—Ralph M. Moschella, third from left, spoke at the Dec. 13 meeting on the topic "Ultrasonic Machining." Manager of Sonic Products, Raytheon Mfg. Co., Mr. Moschella showed a film to illustrate his discussion. Pictured with him, from left: Richard Downing, program chairman; Jakob Mutzbauer, chapter chairman; and Robert Foot. The nominating committee was selected at this meeting. Named to the group were Peter Wilson, R. Wiley, and J. Pepetto.—*Kenneth R. Stowe*

HENDRICK HUDSON—"Grinding" was the topic discussed at the December meeting by Dr. Leo P. Tarasov, seated, far right, research engineer at the Norton Co. Also pictured at the meeting, sponsored by Behr-Manning Corp., are (seated, from left); Donald Clickner, secretary; D. B. Done, treasurer; J. A. Cardone, first vice chairman. Standing: F. R. Adams, second vice chairman; Benet Ripin, editorial chairman; Macmillan McElwain, chairman; M. S. MacKenzie, program chairman; Frank Newell, field engineer, Norton Co.; and John Shirley, staff engineer, Behr-Manning Corp.—*Benet Ripin*

BENTON HARBOR-ST. JOSEPH—Chapter officers and participants in the Dec. 8 program are pictured from left: Robert Potter, program chairman; Lester Tiscornia of Auto Specialties Mfg. Co., new affiliate member; Melvin G. Sulzer, principal technical speaker; Allan Ashley, chapter chairman; Ivan Peters, second vice chairman; Stanley Jabaay, who aided in the round-table discussion; Fred Lindenmayer, membership chairman; and Ewalt Rocks of Whirlpool-Seeger Corp., another new affiliate member.—*Orvis L. Johnson*

RIVERSIDE—Phil Threshie, second from right, presented the Norton Co. program "Grits that Grind" at the Nov. 22 meeting. Shown with the speaker here, from left, are: Les Heustis, first vice chairman; Cy Denny, chapter chairman; and George Hildebrandt, program chairman. Another item on the meeting agenda was naming of Ben Harrison, Elmer Calkins and Harry Hayes to the nominating committee.

—*Oris G. Feuling*

Santa Clara Valley Prepares for National Engineers' Week

Designated National Engineers' Week by a presidential proclamation, the week of Feb. 19-25 will hold special meaning for the members of the Santa Clara Valley chapter who have joined forces to observe it with other engineering societies and organizations in their area.

The Santa Clara Valley Engineers' Week Committee is headed by William C. Lanyon, past chairman of the Santa Clara Valley ASTE chapter.

Plans have been set up to establish a speakers' bureau with Dr. Robert Parden of the University of Santa Clara as chairman. The bureau will furnish technical speakers to schools, service clubs and other civic organizations.

The National Society of Professional Engineers, national sponsors of the week, have furnished prepared packets to help the various committees across the country carry out their activities.

Some of the activities and plans in the Santa Clara Valley area include store window displays featuring engineering, industrial products and equipment of interest to the public.

Radio, television and newspaper media will feature subjects in many fields of engineering presented by the various societies and organizations.

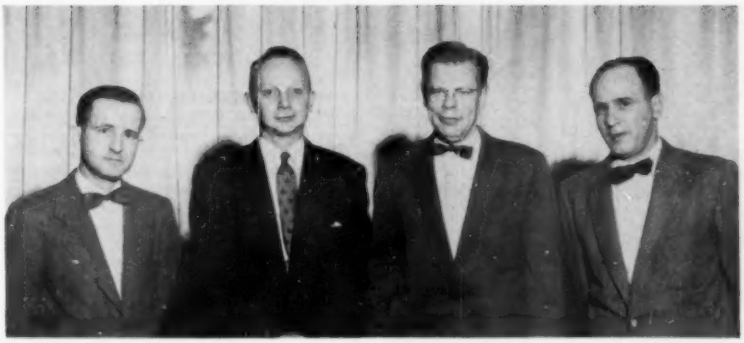
ASTE has procured the now famous "Civilization through Tools" exhibit, sponsored by The DoAll Co. and the Wilkie Foundation. It will be housed at San Jose State College and will be open to the public.

Special attention will be given to high school and college students to interest them in an engineering career.

Support for the program is by donations from industry in the area—as well as special proclamations by state and civic officials.

Position Wanted

DIE SHOP FOREMAN—solid die background of 14 years. Served apprenticeship in the automotive industry. Have been foreman of die shop for past three and one half years, supervising over diemakers and die tryout men. Graduate die design engineer from Acme School of Tool and Die Design Engineering. I am fully capable of engineering, designing, estimating, supervising the building of dies, and the production of units from same. Willing to relocate. Write to Box 066, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.



ALBUQUERQUE—Dec. 20 was the date of the joint meeting held by the Albuquerque chapters of ASTE and ASM. Attendance was well over 175. Speaking to the group was William J. Jackel, second from left, manager of Albuquerque operations and vice president of Nuclear Energy Products Div., ACF Industries, who presented his observations of the United Nations conference on peacetime uses of atomic energy. Others pictured, from left: Julian C. Moody, ASTE chapter chairman; James W. McRae, president of Sandia Corp.; and Nicholas Sannella, ASTE program chairman. *—J. C. Moody*

SPRINGFIELD, MASS.—Speakers at a recent technical session were John E. King, assistant manager, Cold Forming Div., Heintz Mfg. Co.; and Al Lefebvre, right, chief engineer, Stanley Home Products.—*Allan M. Johnson*

Technical Institute Toured by Mohawk

A dinner meeting and tour of the facilities at Mohawk Valley Technical Institute were on the Nov. 22 agenda for members of the Mohawk Valley chapter. Addressing the group was Albert Payne, dean of the school, who described the aims of the institute and told what ASTE members could do in realizing their responsibility to see that more young men have the opportunity to become tool engineers.

Mohawk Valley Technical Institute, one of five such schools in New York state, offers a two-year course for training men for technical positions in local industry.

In October, the chapter heard a lecture by Al Maezer, field engineer for Carboloy Dept. of General Electric Co., on the subject "The Carboloy Machinability Computer." *—G. F. Seely*

Grand River Members Attend Joint Meeting

A combined meeting with the Kitchener-Waterloo branch of Canadian Welding Society, the Engineering Institute of Canada, and the Grand River Valley chapter of ASTE was held Dec. 9 under the auspices of Welding Society members.

Program speaker was H. Thomasson, metals research engineer with Westinghouse of Canada. He spoke on the subject "Plain Talking by a Welding Engineer," covering all types of metals with particular emphasis on the higher alloy steels.

On Nov. 24, ASTE members traveled to Malton to tour the Orenda Jet Engine Plant there. After the dinner served by the company, small groups were guided through the processing of parts and assemblies. A general discussion period followed the tour. *—W. C. Little*

Touring Tool Exhibit Viewed by Piedmont

"Civilization through Tools," exhibit of The DoAll Co., made its stop in North Carolina on Dec. 12 for a meeting of members of the Piedmont chapter. More than 100 were on hand to view the display and hear a talk by C. B. Schelly, managing director of the Wilkie Foundation.

The meeting was a joint session held with the Carolina-Piedmont Section of the American Society of Mechanical Engineers. Both ASME and ASTE conducted brief business sessions before the technical program got under way. *—Howard Blackwood*

Double Header Program Staged at Hamilton

An event of dual importance was the combination Executives' Night and Past Chairmen's Night held by Hamilton District chapter on Dec. 9 at Fischer's Hotel.

Economic advisor to the president of the Steel Co. of Canada, Ltd., Stuart B. Armour gave an informative and encouraging address on Canada's position in International trade, as main speaker on the evening program.

Other highlights of the program included presentation of an official ASTE chapter banner by W. A. Dawson of the advisory committee. Mr. Dawson also traced the history and activities of the chapter since its founding in 1941.

Charles Fischer, chapter chairman in 1942, who is retiring from active participation in chapter activities was presented with a gift from the chapter by Chairman Frank C. Johnson. *—William A. Marcellus*

HAMILTON DISTRICT—Chairman Frank C. Johnson, center, is pictured at the December meeting with Stuart B. Armour, left, and F. L. Hayden.

SEATTLE—Boyd K. Bucey, tool design manager at Boeing Airplane Co., addressed more than 100 members at the November meeting on "Recent Trends in Airframe Manufacturing Techniques." Use of large aluminum castings in tooling and the need for custom tailored machine tools for the aircraft industry were among the points discussed by Mr. Bucey. *—Harold F. Hanson*

LONG ISLAND—Another in the successful series of panel programs was presented by these speakers at the Nov. 28 meeting. "Plastics in Tooling" was the general theme for discussions by, from left: Harry Friedman, chemical engineer, Russell Reinforced Plastics, Inc.; Joseph Mele, development engineer, Grumman Aircraft Engineering Corp.; John Delmonte, general manager, Furance Plastics Inc.; Ben Sokol, supervisor of nonmetallics, Guided Missiles Div., Republic Aviation Corp.; Mel Young, general manager, U. S. Gypsum Co.; and Gilbert R. Herdt, supervisor, facilities planning, Grumman Aircraft Engineering Corp.

Long Island Program Aired by Radio Station

A 'first' was scored by Long Island chapter on Dec. 12 when the main portion of its technical program was broadcast over radio station WGBB, Freeport. The principal speaker was Harry H. Rains, labor relations consultant, who discussed "Human Relations for Engineers."

Mr. Rains opened his talk by making an analogy between tools and human beings, stating that the latter are special tools requiring special handling and that no two are alike.

Emphasizing the development of the proper attitude on the part of the supervisor toward workers, he listed many factors which must be considered to obtain the proper team spirit and cooperation from men under engineers' supervision.

At the brief business session, Sheldon Meyers was elected to finish out Harold Poett's term of office as treasurer. Mr. Poett has moved to California.

—William H. Bruning

Melvin D. Verson Addresses Fond du Lac

Seventy members and guests of Fond du Lac chapter were present for the Dec. 9 meeting at Athearn Hotel in Oshkosh when Melvin D. Verson was the guest technical speaker. Mr. Verson, executive associate at Verson Allsteel Press Co., presented a discussion and two movies on "Press Working." Technical chairman for the evening was Martin Kozak. *—Walter M. Gradolf*

K. M. Traska Named District Manager

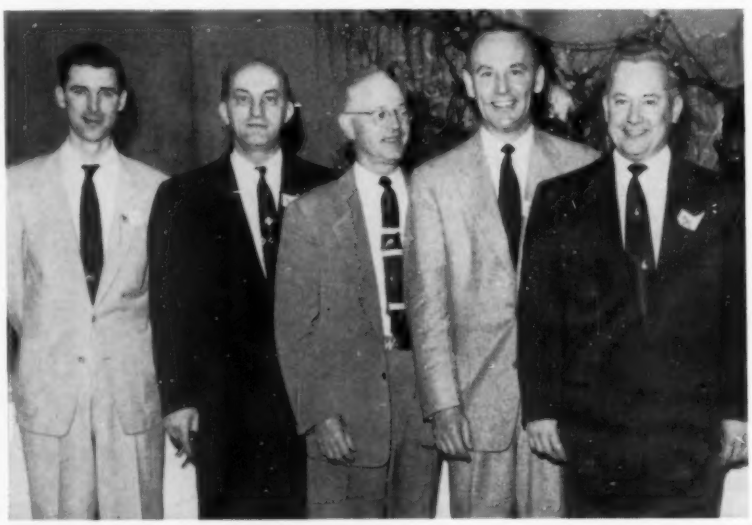
Kenneth M. Traska has been appointed to the newly created position of West Coast district manager for the Formsprag Co., according to an announcement by C. F. Trapp, sales manager of the company. Mr. Kraska, a member of the North Texas ASTE chapter, was associated with Winter Brothers Co. as district sales manager for the past seven years.

Positions Available

SALES ENGINEERS AND DEVELOPMENT ENGINEERS—long established central New England machine tool manufacturer has openings for sales proposal and development engineers. Sound opportunities for men with engineering background experienced in machine tools or closely allied fields. Salaries open; advancement dependent on demonstrated ability. Liberal vacation and benefit program provided. For further information, send complete details of background to Box 063, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

ABRASIVE SALESMAN—sales experience or engineering background desirable. Training in abrasive sales, salary plus incentive with car furnished. Write or contact Bay State Abrasive Products Co., 3771 Chester Ave., Cleveland 14, Ohio. All applicants and information kept confidential.

SALES ENGINEER—25-35. Excellent opportunity for person fully experienced in selling small cutting tools such as milling cutters, end mills, reamers and hobs. Must be familiar with all phases of selling and servicing customers as well as practical experience in the use of these tools. We are looking for a man currently employed in this field who is looking forward to advancement to sales manager. Salary open. Please send complete resume and salary requirements to Box 065, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.



PORTLAND, ORE.—Amato's Supper Club was the scene for the annual Christmas party held Dec. 9. Among those on hand for the evening's program of dinner, dancing and a floor show were, from left: Joe Lomnicki, treasurer; Past Chairman Fred Mondin, program chairman; Andy Winters, standards chairman; Robert C. Erickson, first vice chairman; and Fred Allen, chapter chairman. On Nov. 29 the chapter made a plant tour at the Hyster Co.—*Walter Brenneke*

Chief Metallurgist Speaks at Louis Joliet

Chief metallurgist and service engineer for the Lindberg Engineering Co., Dave Edgerton was the guest technical speaker at Louis Joliet chapter's Dec. 20 meeting.

More than 80 members and guests were present at the Woodruff Hotel to hear Mr. Edgerton give a general run down of heat treating, paying particular attention to die headaches and failures due to improper design in heat treating. He also gave solutions to these problems. Irv Rossing was technical chairman. —*Ken Hanks*

G. T. Eyton Discusses Materials Handling

London-St. Thomas and District chapter members met Nov. 18 to hear a talk on "The Evolution of Materials Handling." Technical speaker was Geoffrey T. Eyton, production control manager, General Motors Diesel, Ltd.

Mr. Eyton traced the history of materials handling from ancient times to the present day. To illustrate the way materials handling affects the cost of a product, the cost of building the great pyramids of Egypt with ancient methods, using today's labor costs, was compared to the cost of building with modern methods and equipment.

The chapter's nominating committee was elected at the meeting. Serving are: Tom Carson as chairman, John Ayling and Omar Kilbourn.

—*Richard J. Merriott*

Special Event Planned by Portland, Ore. Chapter

Oregon State College's School of Engineering will be host to members of the Portland, Ore., chapter for a special program on Thursday, Feb. 16. Scheduled at Corvallis for 8 p.m., in room 301 of Dearborn Hall, the meeting will feature a talk by George W. Gleeson, dean of Oregon State's School of Engineering & Industrial Arts. Dean Gleeson will discuss "Professional Background of Tool Engineers and What To Expect of Automation."

Special guests at the event will be student branches of American Foundrymen's Society, society for the Advancement of Management and American Institute of Industrial Engineers. The program will also feature tours of the engineering and industrial facilities at Oregon State.

Chartered buses will make the 85-mile trip to Corvallis, leaving the Portland depot at 6 p.m.

SOUTHEASTERN MASSACHUSETTS—"Automation" was covered by three speakers at the December meeting held at Taunton. Sulo Aijala, left, machine designer, Metals & Controls Corp., covered servos and mechanical automation; William D. Munro, and Robert Merriam, right, electrical engineers with Spencer Thermostat Div., Metals & Controls, spoke on transducers, servo amplifiers and feed back systems. —*Karl W. Nittel*

SAN FERNANDO VALLEY—Christmas party-goers included, standing from left: Mr. and Mrs. J. R. Bethune, and Mr. and Mrs. Charles L. Goodspeed. Seated are: Prof. Lindskog, who entertained the holiday audience with an amusing lecture on space travel; Mr. and Mrs. Robert C. Broomell, and Mr. and Mrs. Alfred T. Rando. In addition to a floor show, the evening's program included dinner and dancing. —*Sam Schwartz*

WORCESTER—"Tapping" was the technical topic at a recent meeting, with S. H. Chaffee, seated, second from left, chief engineer, Greenfield Tap & Die Co., as program speaker. Pictured, seated from left, are: Arthur Hird, Mr. Chaffee, J. Irving England, chairman, Leo Tarasov, and John Donovan, district manager for Greenfield. Standing: Robert Humphrey, John Lalor, Kass Carpen, George Gershman and John Rotchford.—*Ronald Mead*

coming ASTE meetings

National

NATIONAL PROGRESS COMMITTEE—Feb. 3, National Headquarters, Detroit.

NATIONAL STANDARDS COMMITTEE — Feb. 3, Statler Hotel, Detroit.

NATIONAL PUBLIC RELATIONS COMMITTEE—Feb. 4, National Headquarters, Detroit.

CANADIAN AREA MEETING—Feb. 18, St. Catherines, Ont.

NATIONAL OFFICERS—Feb. 24, National Headquarters, Detroit.

NATIONAL FINANCE COMMITTEE—Feb. 10, National Headquarters, Detroit.

Chapter

BOSTON—Feb. 9, 6:30 p.m., New England Mutual Hall, Boston. "Why Diamonds?" by C. Randolph Myer, manager, Abrasive Div., Elgin National Watch Co. Election night.

COLUMBUS—Feb. 8, "Welding" by Joseph Spetnack of Ohio State University. Election night.

DAYTON—Feb. 13. Program by Illinois Tool and election of officers.

DETROIT—Feb. 16, senior section, 8 p.m., Auditorium of Engineering Society Bldg. Election of officers.

FOND DU LAC—Feb. 10, 6:30 p.m., Oshkosh. Contact N. R. Boynton of Oshkosh for reservations.

FORT WAYNE—Feb. 8, 6:45 p.m., Hobby Ranch House. Election of officers and entertainment.

GRANITE STATE—Feb. 21, 8 p.m., Somersworth, N. H. Tour of General Electric Co.

GREATER NEW YORK—Feb. 6, 8 p.m., New York Times Bldg. "Hydraulics" by Martin Lipton of the Airoyal Co. Dinner at 6:30 p.m.

HAMILTON DISTRICT—Feb. 10. Members' Night. "Machine Tool Hydraulics" by Stan Thibodeau.

HENDRICK HUDSON—Feb. 15, 6:30 p.m., Circle Inn, Latham, N. Y. "Silicones for Industrial Applications" by Carl Petroski, marketing salesman for General Electric Co.

LANSING—Feb. 13, 6:45 p.m., Stephens T. Mason Bldg. "What Is Automation?" by Charles F. Hautau, chief engineer, Hautau Engineering Co.

LEHIGH VALLEY—Feb. 17, 8 p.m., Hotel Traylor, Allentown, Pa. "The Art of Jigless Boring" by a representative of DeVlieg Machine Co.

LONG ISLAND—Feb. 13, 8:30 p.m., Garden City Hotel, Garden City, L. I., N. Y. "Production Tool Development" by Bernard Better, director of research, Scully Jones & Co.

LOUIS JOLIET—Feb. 21. Election of officers and buffet stag luncheon for members only. No technical program.

LOUISVILLE—Feb. 14, 6:30 p.m. Shawnee Post of American Legion. Election of officers.

MID-HUDSON—Feb. 14. "Plastic Tooling" by Virgil Herman of Renite Plastic Co. Also film "Fishing in New York State."

MONADNOCK—Feb. 16. "What's a Silicone?" by J. T. Duane of Dow Corning Corp.

NEBRASKA—Feb. 16, Omaha. "Capital Investment" by a representative of Verson Allsteel Press Co. Employers' Night.

NORTHERN MASSACHUSETTS—Feb. 21, Gardner, Mass. "The Meaning of Machine Tools" by H. E. Linsley, associate editor of *American Machinist*.

NORTHERN NEW JERSEY—Feb. 14. "Investment Castings for Engineers" by W. O. Sweeney of Arwood Precision Casting Corp. Election of officers.

PHILADELPHIA—Feb. 16, Engineers' Club. "Jigless Boring" by C. B. DeVlieg, president of DeVlieg Machine Co.

PIEDMONT—Feb. 13, Robert E. Lee Hotel, Winston-Salem, N. C. "Broaching Practice" by Joseph A. Psenka, field broaching engineer for National Broach and Machine Co.

ASTE Industrial Exposition and 24th Annual Meeting will be held March 19 through 23, 1956, at Chicago, Ill. The Exposition will be held at the International Ampitheatre.

PITTSBURGH—Feb. 3, 6:30 p.m., Gateway Plaza. "The Technique of Micro-Drilling" by John A. Cupler, III, president, National Jet Co.

PORTLAND, ORE.—Feb. 16, 8 p.m., Dearborn Hall, Oregon State College, Corvallis, Ore.

SANTA CLARA VALLEY—Feb. 21, San Jose State College, San Jose, Calif. "Civilization through Tools" courtesy of The DoAll Co.

SCHENECTADY—Feb. 13, 8 p.m., American Legion Post #21, Schenectady. "Gears and Gear Shaving" by Ben Bregi, vice president of engineering, National Broach & Machine Co.

SOUTHEASTERN MASSACHUSETTS — Feb. 21, Cotillion Room, Taunton, Mass. "Alloy and Alloy Steels" by H. A. Johnson of Vanadium Alloys Steel Co.

TRI-CITIES—Feb. 8. "Facts about Taps and Tapping" by Frank Mertz of Greenfield Tap & Die Corp.

TWIN STATES—Feb. 8, Windsor, Vt. "Die Casting—How Else Would You Make It?" by representatives of American Zinc Institute.

WINDSOR—Feb. 13, 6:45 p.m., Bellevue Tavern, Windsor. "The Use of Nuclear Energy in Metal-Cutting Research" by R. T. Hook, chief metallurgist at Warner & Swasey Co. Meeting sponsored by Williams & Wilson, Ltd.

WORCESTER—Feb. 7, 7 p.m., Putnam & Thurston's. "Automation" by Anderson Ashburn of *American Machinist* as well as speakers from local industries. Election of officers.

Portland, Me., Chapter Holds Father-Son Night

The Dec. 9 meeting of Portland, Me., members was designated as father-son night. A nontechnical program was held at the Graymore Hotel, with about 40 in attendance.

Speaker was Capt. Harry A. Rowe of the United States Air Force. He showed a film on pilot training in the Air Force and discussed the newly established Air Force Academy. New developments in the aircraft industry were also covered.

Announcement was made that a new committee has been formed in the chapter for the purpose of visiting members and past members who are on the 'sick list.'

—Robert P. Chaplin

Broaching Films Shown at Northern Massachusetts

"Automotive Broaching and Electro-Mechanical Broaching" was the title of the technical session presented Dec. 13 at a meeting of Northern Massachusetts chapter. About 125 members attended.

The program was presented by Carrol Edgar, research and development engineer, Lapointe Machine Tool Co. Two sound-color films were shown, one on automotive broaching, depicting how the Ford Motor Co. machines cylinder heads and blocks in one pass.

—Otto S. Nau

Fairfield Members Hear Talk by H. W. Bollman

"How Else Would You Make It" was the title of the technical talk given at Fairfield County's Dec. 6 meeting. H. W. Bollman, sales manager for the Newton-New Haven Co., discussed die casting and told what to expect from die cast parts. A color-sound film illustrated the program. About 60 members and guests were present.

—Henry E. Busby

Santa Clara Valley Names New Committee Chairmen

Among the actions taken at a recent executive meeting of Santa Clara Valley chapter, was the appointment of chairmen to four committees. Two were named to fill vacancies caused by transfers, and the others were named to newly established committees.

In the latter category, James E. Meyer was appointed head of the book committee and Dave Shipley was made chairman of the advertising committee. Filling the vacant positions are Hod Holt, public relations chairman, and A. P. Manino, membership chairman.

Announcement was also made that San Jose State College extension services division is holding a special engineering review course to assist engineers in passing the professional engineering examinations in June. Classes will run from Feb. 14 to May 23, and will be conducted at Peter Burnett junior high school in San Jose and at Fremont Union high school in Sunnyvale.

—W. H. Forbes

LANSING—Warren D. Getchell, right, was guest speaker at Lansing chapter's first ladies' night on Dec. 12. Mr. Getchell, consulting engineer for McCrosky Tool Corp., presented a travelogue, "A Trip around the World" for 128 members and wives. Chairman William Janetske thanks him.

—R. J. Krumrie

WINDSOR—These members of the chapter standards committee are currently studying the provisions of the Joint Industry Conference electrical standard for machine tool equipment, with the aim in mind of presenting a technical session on the subject for the total membership of the chapter. This approach follows the successful pattern used last year in staging a program on the JIC hydraulic standard. Pictured, from left: E. Clifton, A. Horton, L. R. Shelson, D. L. Swan (chairman), N. Paddison, R. A. Reddoch, G. Kovosi, W. H. Maddoch (vice chairman), J. Ogg, H. Scholtz, and D. Nesbit. Messrs. Horton, Shelson and Scholtz were guests at this particular meeting.

John Lengbridge Speaks to Windsor Members

Some 120 members and guests of Windsor chapter were present Dec. 12 for a discussion of deep drawing and extruding aluminum. Speaking to the group was John Lengbridge who covered aluminum presswork, from shallow forming to deep drawing.

Particular stress was given to "flow of metal" with slides showing the progressive change in shape and the amount of change in shape. Special attention was given to flow in rectangular forms. Other portions of the lecture were devoted to: flow control by blank holder pressure, reduction factors in drawing operations, redrawing operations, and dies for drawing and draw tools for single-action presses.

—F. D. Rail

Dr. Robert Pearse Speaks at Chicago

Executive vice president of Worthington Associates, Dr. Robert F. Pearse was the guest speaker at Chicago's Dec. 13 meeting at Nielsen's Restaurant. Some 175 attended to hear Dr. Pearse discuss "Developing Tool Engineers into Manufacturing Executives."

Dr. Pearse showed the close relation between personality factors and work effectiveness and demonstrated a way in which personality tests can be used in developing executive performance.

The evening program was rounded out by a smorgasbord dinner and entertainment by the Lindberg Chorus of 28 men and women.

—L. B. Klemme

Dorian Shainin Talks at Merrimack Valley

Showing how quality control helps solve difficult tooling problems, Dorian Shainin spoke before 45 members of the Merrimack Valley chapter on Dec. 1. Chief quality control engineer for Rath and Strong, Inc., Mr. Shainin utilized slides and blackboard illustrations to explain the laws of probability and to demonstrate their use in precontrol of typical tooling problems.

—Arthur E. Clement

Touring Exhibit Visits Memphis Chapter

"Civilization through Tools," widely known exhibit and program sponsored by The DoAll Co. and the Wilkie Foundation, landed in Memphis for the ASTE chapter meeting on Dec. 2 at the William R. Moore School of Technology.

More than 100 were on hand for the program and talk by C. G. Schelly, managing director of the Wilkie Foundation, who is traveling commentator with the exhibit which depicts specific eras of tooling throughout history.

—Ralph Schuring

S. B. Jeffreys Becomes Professional Engineer

Owner of the Jeffreys Engineering & Equipment Co. of Greensboro, N. C., Sidney B. Jeffreys joins the ranks of professional engineers, having passed the state examination in North Carolina. Mr. Jeffreys is a member of the Piedmont chapter.

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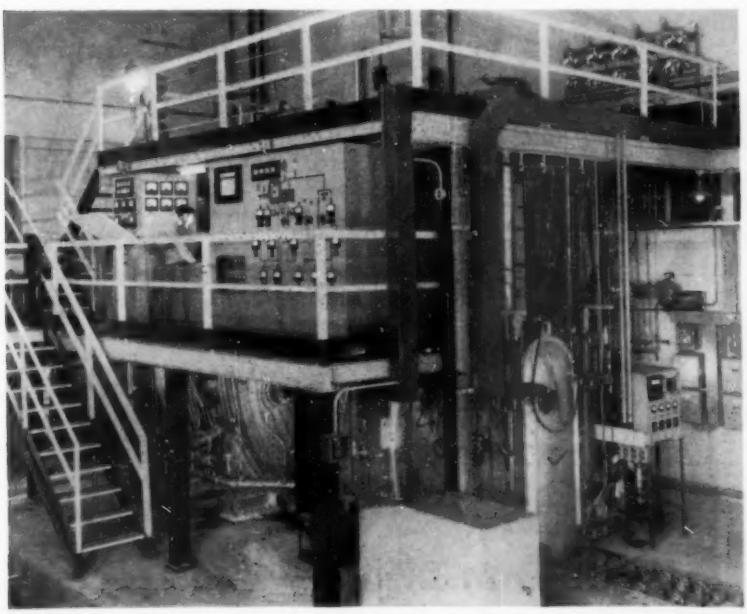
PROGRESS IN PRODUCTION

NATION'S LARGEST VACUUM MELTING FURNACE GOES TO WORK

Tapping of the new vacuum melting furnace at Syracuse, N.Y. by its joint owners, Crucible Steel Co. of America and National Research Corp., put into operation the largest such furnace in this country. With this 2200-lb. unit, the monthly potential supply of vacuum melted metal for industry will be increased by 60 to 75 tons. This equipment is remotely operated by the melter who can control the charging, mold transfer and pouring operations from a single console. An air tight, liquid cooled stainless steel chamber ¾ in. thick encloses the unit. Connecting air lock chambers are provided to permit charging raw materials and discharging ingots. Charging, melting, pouring and removing ingots all may be made without affecting the vacuum in the melting chamber. Another feature of the design is the mold handling mechanism which makes it possible to cast ingots of varying size and shape, either singly or in multiples from a single heat.

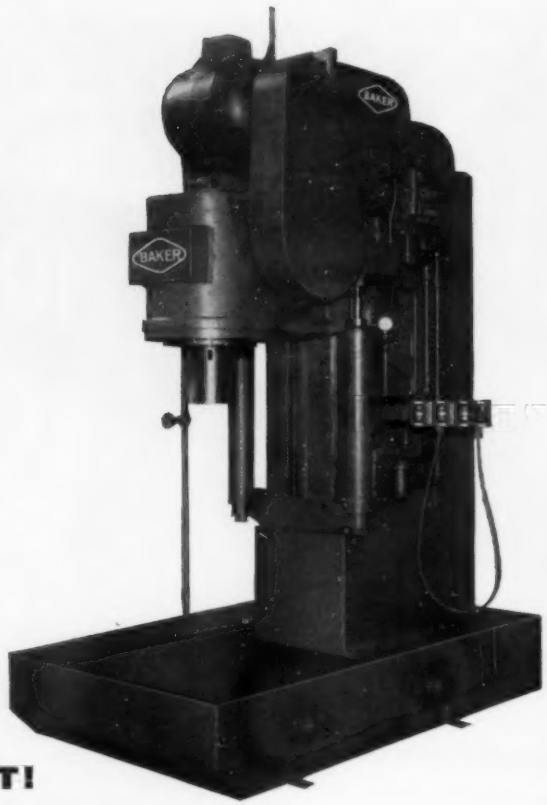


Design, based on five years' operating experience with semi-continuous vacuum furnaces, was under direction of D. M. H. Hnilicka of the Research Div. of National Research. Construction was carried out by the Equipment Div. of National Research, and the engineering department of the Sanderson-Halcomb Works of Crucible Steel installed it under the direction of W. K. Lowe, chief engineer.

Metals melted in a vacuum offer unusually high qualities in such properties as stress rupture strength and ductility, fatigue strength, notch ductility and impact resistance. The products also are characterized by cleanliness and low gas content, and consequently higher elevated temperature strength.

EXPERIMENTAL DIE CASTING OF ALUMINUM ENGINE BLOCKS

Successful development of an aluminum die cast engine block forecasts a weight saving of 132 lb plus time and cost economies. The new block was produced on an experimental basis at a Toledo plant of Doehler-Jarvis Div. of National Lead Co. Machine selected to



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turn out these castings, possibly the world's largest die casting machine, is capable of handling dies weighing up to 50 tons. Development resulted from a joint project of National Lead and Kaiser Aluminum and Chemical Corp.

As opposed to the 175 lb which the same engine block would weight if cast in gray iron, the new straight-type engine block weighs about 50 lb as it comes from the die casting machine, and 43 lb when trimmed. This represents the largest die casting known to be made in aluminum. Besides the inherent lighter weight of aluminum, savings also were made by the reduced wall

First die cast aluminum six-cylinder motor blocks come down the conveyor line. In the background may be seen the mammoth die casting machine which is producing these castings at the Doehler-Jarvis plant in Toledo.

thickness which it was possible to use. Further economy may be realized because the die cast block needs much less machining than the former blocks since machining is confined to the main sealing areas. In these engines, too, all the 129 holes are cored and cast to size and no holes need be drilled in the block.

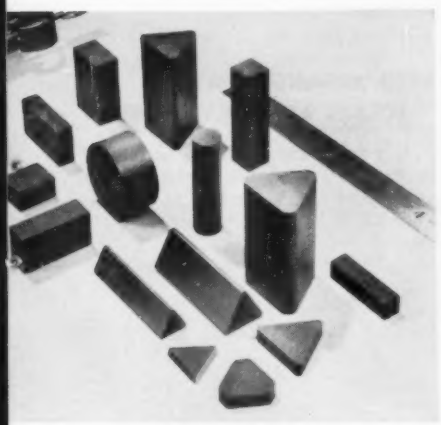
Other advantages also seem apparent through the new development. Heat conductivity of aluminum is considerably higher than that of gray iron, and an engine block in aluminum would require a less complicated cooling system. Smooth surface of the casting also prevents occurence of uncontrollable sections and sand pockets which restrict flow of cooling water.

Statistics indicate the new engine block can be produced at a rate of 30 to 35 pieces per hour on a single machine, using about 1700 lb of molten aluminum.

CERAMIC TOOLS DEVELOPED FOR SPEED AND STRENGTH

With the first of the year, shipments of the newly developed oxide-base cutting tool material Stupalox began moving in commercial quantities. This ceramic cutting material, developed by the Stupakoff Div. of The Carborundum Co., will cut cast steel, cast iron, chilled iron, carbon steel, high-speed steel and nonferrous materials. Under controlled conditions, it cuts up to 2,000 sfpm; however, it is difficult to get exact measurements of its ability because of test machine and horsepower drive limitations.

Several specific advantages are reported on the new material. It cuts with no build-up on the cutting edge and no cratering adjacent to it. It is



Ceramic tools are offered by Stupakoff in a variety of forms. Scale in background provides a reference for size.

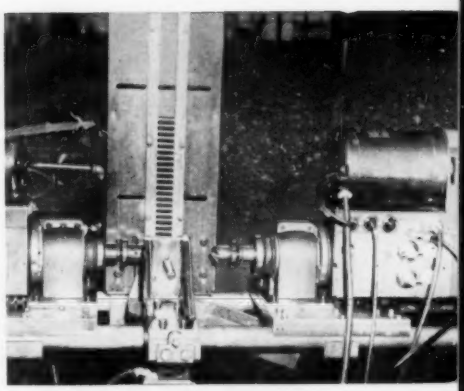
reported to be hardest of the metallic tools—91 to 95 R_A, is unusually abrasion resistant; maintains its strength at temperatures usually detrimental to cutting materials; provides excellent surface finishes, and does not generate as high heat as metallic tools.

According to results of demonstration tests, the new material will machine high-speed steel at a speed of 505 sfpm with 0.024 in. feed and 0.125 in. depth of cut. However, in this case, this was the cutting speed limit of the machine used, so results may be inconclusive. When cutting SAE 1035 steel, Stupalox permitted a speed of 1175 sfpm; feed in this test was varied from 0.015 to 0.005 in., and depth of cut from 0.005 to 0.250 in. to show tool versatility. On the sometimes-classed "unmachinable" Nimonic 80-A, Stupalox cut at a speed of 40 sfpm at 0.005 in. feed and 0.100 in. depth of cut. In the test, a 3-ft. length of the material was machined in 4 minutes without changing the tool.

AUTOMATIC SETUP HELPS SMALL PLANT

Advantages of automation can extend to the small shop through ingenious use of standard equipment. In specific application at Star Tubular Products Co. on a facing and deburring operation on welded steel pipe sections, this approach resulted in a 300 percent production increase. Although a pair of automatic drill units were the only major equipment added to existing facilities, production mounted to 500 pieces per hour as compared to previous 135 pieces per hour.

All pneumatic and electric controls were built into the standard automatic Dumore drill units, simplifying installation and reducing control problems. With the new setup, pipe sections are



Pipe sections, in hopper at rear, are delivered to the dual drill setup for simultaneous facing and deburring.

LOOK AT THIS UP-TO-THE-MINUTE EXHIBIT OF

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EXHIBIT A

POPE SUPER-PRECISION, HEAVY DUTY BORING SPINDLES for boring holes round within millionths of an inch. Available in both belt driven and motorized units to meet a wide range of speeds and horsepower. Send us your specifications for quotations.

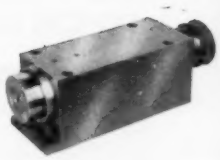
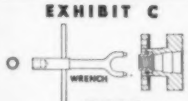


EXHIBIT B

POPE 1 HP, TOTALLY ENCLOSED 3600 RPM MOTORIZED, CARTRIDGE TYPE PRECISION SPINDLES with double row cylindrical roller bearings and separate thrust bearings for no endwise movement of the shaft

EXHIBIT C



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The illustration shows a lens grinding block being heated within the dome-shaped work coil. The heat generated in the metal block softens the pitch enabling the operator to remove the ground lenses and insert the next batch. The entire operation is completed in a few seconds.

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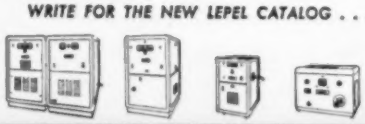

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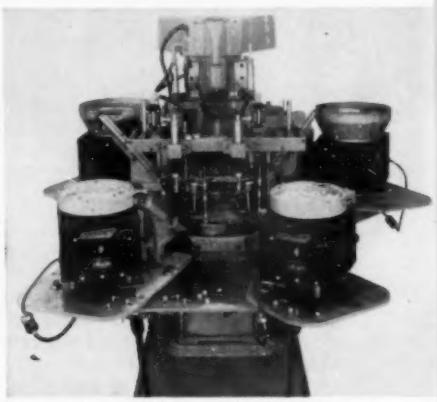
stacked in a hopper which delivers them to a fixture. Here a clamping device is immediately actuated. At the same time, the two drill units are triggered so that both drill heads advance simultaneously, face and deburr both ends of the part and then retract. Work feed is controlled through the automatic circuits in the drill units.

Besides increased production, the setup offers the advantage of increased accuracy and consequently permits the company to roll cut the pipe sections instead of square cutting them.

Prior to this arrangement, the facing and deburring job required handling each part three times. One end was completed, then the part was removed in a separate handling operation, reversed in the work fixture, and finally the opposite end was faced and deburred.

FEED ARRANGEMENT SOLVES ASSEMBLY PROBLEM

A troublesome problem pertaining to headlamp assemblies used on current model cars was solved at The Bodine Corp. by a clever feed arrangement. These headlamps are set by adjusting screws carrying nylon nuts



Four automatic hopper feeds are arranged around a standard basic tapping unit so that at each stroke two nuts are delivered to the dial feed and two screws are fed to the tapping stations for rapid assembly.

which bear on the headlamp assembly. The nylon nuts are unthreaded, however, the assembly requires an accuracy within two turns. Economy also is a factor.

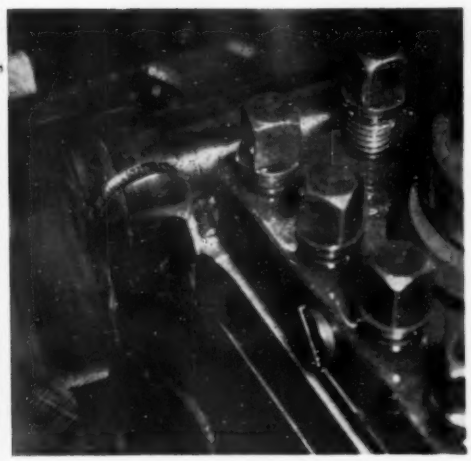
Solution came through use of a standard basic tapping machine equipped with a dial feed and four automatic hopper feeds. In this setup, two hoppers deliver nuts and two deliver screws. With the machine oper-

ating at 30 strokes per minute, the hoppers deliver two nuts to the dial at each stroke; two screws are fed to the tapping stations. The screws are used as taps and are driven into the unthreaded nuts in twin operations. The function takes less than two seconds with a consequent production rate of 3000 pieces per hour, while accuracy of the assembly is consistently within a half turn.

CERAMICS HANDLE TOUGH CUTS

Recently developed ceramic tools are demonstrating that they can effectively cut high-strength steels under shop operating conditions at the Glenn L. Martin Co. These tools are made of Alsimag 614 furnished by the American Lava Corp. First of the tools were made in square and triangular shapes.

Originally the tools were developed for use on engine and turret lathes. However, complete evaluation tests now



Closeup view of Alsimag 614 cutting tool as it cuts a bar of 4340 steel.

under way are using them for milling, drilling and other machining operations, in addition to lathe turning. So far the tests show that the ceramics cut high heat-treated 4340 steel to a depth of 0.218 in. and knock the corners off square, hexagonal and oblong bars without either breaking or dulling the cutter.

Further advantage of these tools is that they will successfully make interrupted cuts. For example, in preliminary tests, these ceramics made a 0.125-in. cut at 180 sfpm in 1½-in. hexagonal bar 4340 steel. Speed was 464 rpm; feed was 0.010 ipr; and no coolant was used.

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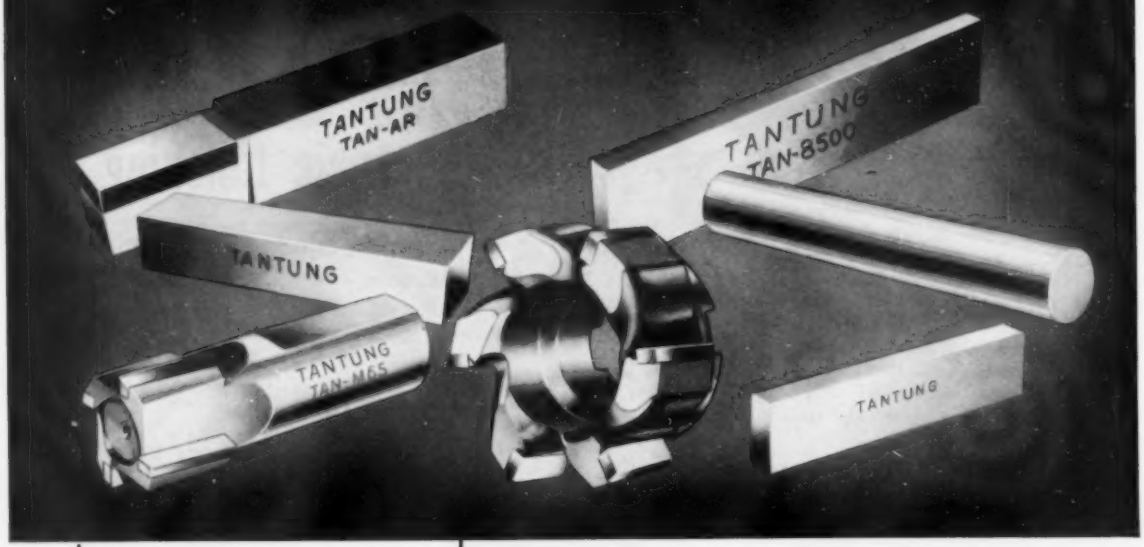

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- **TANTUNG HAS HIGH RED-HARDNESS**—it maintains its 60 to 63 Rockwell C hardness at temperatures high into the red heat range.
- **TANTUNG IS EASY TO GRIND**—aluminum oxide wheels used for hardened steel are suitable.
- **TANTUNG IS AVAILABLE PREFORMED** — when you buy preformed tools, you save grinding costs and get better cutting quality and longer tool life.

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TOOLS of today

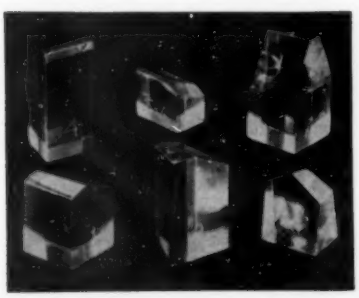
Diamond Tools

Diamond tools for machining small precision metal parts to extremely close tolerances and for producing a machined surface of mirror-finish smoothness include a number of turning tools for cutoff and for finish-turning of flat or bevelled surfaces.

These turning tools are available for any type of cutoff operation and for finishing of flat surfaces or bevelled surfaces of any desired bevel angle. They are produced by a special manufacturing procedure which includes examination of the diamond by X-rays to determine the arrangement of its atom planes, then orienting these planes in the tool so as to produce exceptionally long tool life as well as an unusually smooth machined surface.

They have been particularly useful in application for machining soft, nonferrous metals to tolerances as close as ten-thousandths of an inch, and for producing a machined surface so smooth that no polishing or other finishing is required.

Allied Products Div., Hamilton Watch Co., Lancaster, Pa. **T-2-1531**



Tool and Die Milling Machines

A tool and die milling machine, called the Contourmaster, is especially suited to the accurate, economical production of small-sized contoured shapes such as plastic molds, die casting dies, forging dies, master hobs, glass molds, etc.

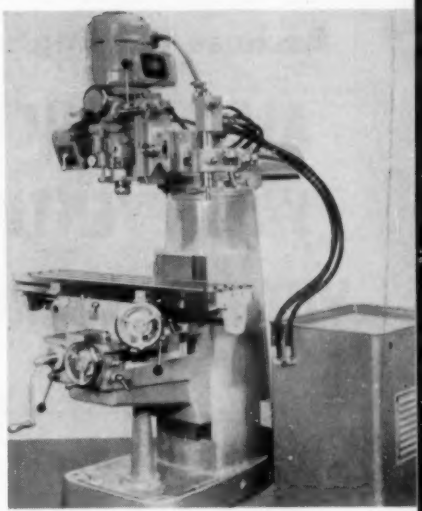
It accomplishes rapid machining operations, while also reducing the amount of subsequent handwork required.

Features of the unit include automatic hydraulic depth tracer, antifriction hand feed screws and a front table hand control. In addition, the cutter head and tracer mechanism are swivel mounted, as are the shaping attachment and micrometer depth gage.

The column of this knee-and-column type construction is truncated to provide a turret-like swivel mount for the cross sliding ram which carries the spindle head. This swivel mount permits a shaping attachment, carried on the rear of the cross ram, to be instantly swung into position over the workpiece for shaping or slotting operations.

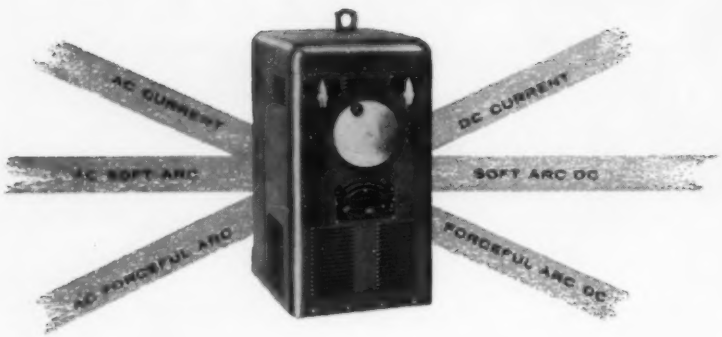
Mounting the spindle head on the front of the cross ram in segmental circular ways allows front-to-back swivel of the spindle carrier and tracer mechanism and keeps the tip of cutter and tracer close to their normal operating position even when the head is swiveled to the maximum angular positions.

The machine is supplied in two styles: Style 1A is the basic machine having 16-in. table travel, Acme type feed screws for table and saddle, and



with table feed handwheels at each end of the table. Style 1B has 22-in. table travel, antifriction ball-bearing type lead screws and nuts for effortless table and saddle movements, and a front table control handwheel located close to saddle feed handwheel.

Both styles are equipped with an automatic, hydraulic depth control tracer mechanism coupled to the quill-mounted spindle. Vertical spindle movements, synchronized with table or saddle movements, are controlled by a guiding template to accurately reproduce even slightest variations in surface contour. Lightness of the tracer finger contact pressure permits use of easily worked materials for the master shape. The tracer mechanism can be instantly disengaged when the machine



Because welding costs can be cut more:

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Shouldn't you start using Lincoln Idealarcs now?

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2. Idealarc handles all your jobs AC and DC. You can standardize on *one* machine for all production welding. You can buy Idealarc as an AC-DC machine . . . or as a straight AC welder to which a DC unit can be added at any time.

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THE LINCOLN ELECTRIC COMPANY
Dept. 5007 • Cleveland 17, Ohio
The World's Largest Manufacturer of Arc Welding Equipment

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is to be used for conventional milling operations, while micrometer graduated positioning adjustments for the tracer mechanism provide fast setups.

The conventional operations the quill is provided with dual hand controls, a slow feed handwheel for boring operations and a fast-acting lever to permit use as a sensitive drill. Accurate positioning of the quill is simplified by an easy-to-read micrometer dial depth gage.

Eight spindle speeds range from 215 to 5650 rpm. Spindle drive is by multiple step pulleys and V-belts.

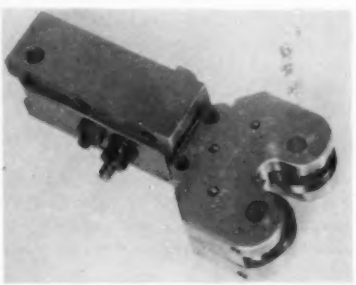
Spindle nose is of the collet chuck type, and collets are available for ¼ to ¾-in. diam straight shank cutters, Nos. 5 and 7 B&S tapers, and Nos. 1 and 2 Morse tapers. A simple, positive spindle lock simplifies cutter changes in the collet chuck.

The Cincinnati Milling Machine Co., Cincinnati 9, Ohio. **T-2-1541**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Thread Rolling Attachments

Two universal pipe thread rolling attachments, Models PT-6 and PT-7, have been added to the Salvo line for use on most types of hand and automatic screw machines, lathes, Bullards and other turning machines. The new



units will roll several sizes of both NPT and NPTF threads.

Model PT-6, for machines of 1¼-in. capacity and larger, will roll ⅛, ¼, ⅜, ½ and ¾-in. pipe threads, while Model PT-7, for machines of 9/16-in. capacity and larger, will roll ⅛, ¼ and ⅜-in. threads. With these attachments, which operate on the machine during the machine cycle, there is no need for special threading machines or other secondary threading operations.

Interchange of thread rolls gives the units versatility regarding thread size, and also enables use of the attach-

ments for both high and low production runs with substantial cost savings. Threads are held accurate to 0.0005 in. over long runs without die adjustment. Roll life up to 10 times normal expectancy is obtainable due to unusual design features of the unit.

Design of the Salvo attachments permits rolling within ½ thread of a shoulder on the part and also permits tapping, drilling, reaming, etc., in the same machine position. Immovable construction of the thread roll holder plus a minimum of adjustable parts enables the 30-lb attachment to do the work of special purpose machines weighing several tons.

Rolling of threads at substantial distances from the chuck or collet of the machine, as well as threading of thinner walled parts is possible since the thread roll shafts are not parallel but are crossed at an angle. Reduction in contact area between the rolls and the part at any given instant during the rolling operation reduces both compressive and cross slide pressures as threads are formed. Hence, forces which would tend to bend or spring a long part or collapse a thin-walled part are reduced.

Threading with roll axes parallel, on the other hand, forms all threads simultaneously and thus requires application of much greater pressures.

Salvo Tool & Engineering Co., 26441 Gratiot Ave., Roseville, Mich. **T-2-1551**

Automatic Bolt Trimmer

This machine, using the cold-flow principle, automatically trims, reduces and rounds off ends of bolts, machine screws and other fasteners in a single operation, in addition to pressing heads of socket screws. Its sturdy construction permits final pressing of bolts with special head shapes that have been rough pressed on double-blow cold upsetting machines. Reduction of bolts, normally required for subsequent thread rolling, can be carried out simultaneously with the trimming process or it can be handled as a separate operation.

A horizontal crank press, it is designed for strength and rigidity during operation. Standard models are supplied with direct motor drive and push-button control.

Flow lines of material in the bolt heads indicate unusually high strength and quality. With the Model AAG-III, bolts up to 0.118-in. diam under the head can be reduced; reduction of bolts up to 0.787-in. diam under the head is possible with Model AAG-00.

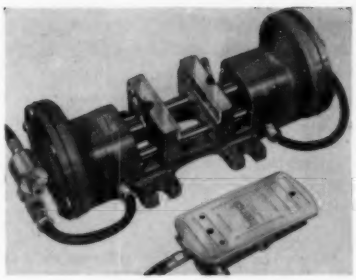
Haller, Inc., 684 Ann Arbor Rd., Plymouth, Mich. **T-2-1552**

Self-Centering Air Vise

Model 22 self-centering air vise is designed for holding parts varying in size or shape when the work requires the location of a center or other predetermined point.

This tool finds workpiece center or other point because its two opposing jaws are each actuated directly by an air cylinder on both sides of the vise. Movement of the jaws is synchronized within a tolerance of 0.001 in. by a gear and rack concealed within the body casting and fully protected from dirt, chips and coolant. No pressure is transmitted through the centering mechanism. It serves only to assure uniformity of jaw travel.

Wide clearance design between jaws permits drilling completely through a



held workpiece without interference. The four-inch wide vise jaws have a maximum travel of ⅜ in. for each jaw. Vise jaws are infinitely adjustable to 4⅛-in. opening.

Holding power of the vise is the total pressure exerted by both cylinders, or

Never Confuse the No. 8 MARVEL with an ordinary Band Saw

...only the MARVEL is Universal

Only on a MARVEL No. 8 does the blade remain at a right angle throughout its full 18" feed traverse. Work always remains stationary.

Only on a No. 8 MARVEL can the saw column be instantly indexed and locked at any angle from 45° right to 45° left, and the saw then fed thru the work at the desired angle — without moving the work.

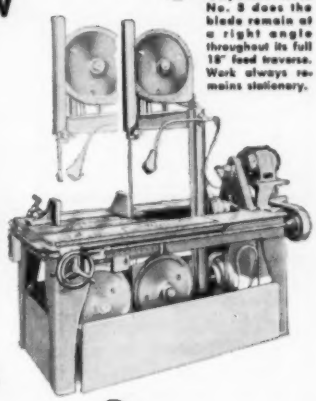
Only a No. 8 MARVEL can do all of these things: Snip-off a ½" rod or cut-off an 18" x 18" cross section.

Rough to Size and Shape

Miter

Index

cut off and shape Structural Beams



Only a No. 8 MARVEL has the large T-slotted work table, with removable quick action vise, that permits accurate set-ups of work of unrestricted sizes and shapes, special fixtures; Etc.

"Rough Machine" to size and shape with minimun chip waste

The No. 8 MARVEL is the "busiest tool in the shop" wherever installed because it is a *universal* tool—has both the capacity and the versatility to handle not only standard sawing jobs but innumerable "trick" and convenience jobs as well. More than a metal saw, the No. 8 MARVEL is a fine machine tool with machine tool features like: Both power and hand feeds; Depth Stops; Automatic Blade Tension; Built-in Coolant Pump; Three operating speeds (or six with 2-speed motor). Moisture-proof electrical controls that conform to both "J.I.C." and "MACHINE TOOL" electrical standards; Dirt-proof ball bearings, etc.

If you cut, machine or fabricate metal, this is a sawing machine you should know about. Write for catalog.

MARVEL Metal Cutting SAWS
Better Machines-Better Blades

ARMSTRONG-BLUM MFG. CO. • 5700 West Bloomingdale Avenue • Chicago 39, U.S.A.
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up to 15 times air line pressure for each cylinder. Control of the vise is by a foot treadle which keeps vise jaws open or closed without constant foot pressure. The vise is fast and easy to set with simple, ratchet-operated, triple-lead thread adjusting screw locked by setscrew on top of jaws. Hold-down lugs permit attachment to bench or machine.

The tool has a quick exhaust valve for rapid jaw return which can also be used for air ejection of parts or chips. The air vise has one set of removable soft-steel recessed parallel jaws. False jaws can be fitted to the jaw castings so that any shape of part may be correctly positioned.

Heinrich Tools Inc., Racine, Wis. **T-2-1561**

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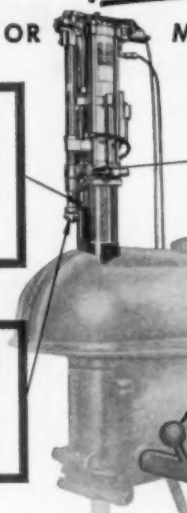
Convert your DRILL PRESS *into an Automatic!*

SINGLE OR MULTIPLE SPINDLE



SET RAPID APPROACH to any length up to 4" + stroke with rapid cycle dial. Saves time. Ideal for jig tumbling.

SET DRILLING SPEED to material hardness with Feed Valve Dial. Adjusts to an infinite range of speeds. Increases drill and tap life.

ADJUST DRILLING DEPTH to .002 plus or minus accuracy with micrometer type Depth Dial.

MANUAL LEVER CAN BE USED ANYTIME for manual drilling or guiding in jig tumbling.

FOR DRILLING • TAPPING • REAMING • THREADING
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AIR OPERATED AND HYDRAULICALLY CONTROLLED, the General Automatic Drill Feed is a precision instrument. Carries warrantee of parts. Has operated continuously for over 10 years without replacement of parts. Hand and foot pedal release provide dual safety factor. Write for complete facts and new reduced prices to General-Pacific Corporation, 8740 Washington Blvd., Culver City, California.

GENERAL AIR OPERATED-HYDRAULIC CONTROLLED
Multi-Speed DRILL FEED

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Time-Energy Analyzer

The two elements, productive time and productive energy, are integrated in this analyzer to determine: machine utilization; best cutting tool, cutting oil and coolant for a given job; cutting tool life standards; machinability index; necessary horsepower at the tool to remove 1 cu in. of metal per minute; tangential cutting force in pounds at

the tool; cutting tool efficiency index; and rate of doing work and work standards.

This portable P-T-E Analyzer is designed for use under severe operating conditions. It is adaptable to either 220 or 440-volt, 3-phase, 60 cycle current for driving motors 1 to 30 hp at 220 volt, 2 to 60 hp at 440 volt. Accuracy is 0.2 percent for a given test and within ±1.5 percent over the entire operating range.

Instrument operation is automatic; it can be locked and will integrate for any time period unattended.

Stewart Instrument Co., 6507 Grand River, Detroit 8, Mich. **T-2-1562**

Induction Heaters

A line of electronic induction heaters is available in 16 models in four output ratings for brazing, soldering, surface hardening and annealing.

The many combinations of models and ratings permit users to select the best heater for specific operating requirements.

These induction heaters have 7½, 15, 25 and 40-kw rated outputs. Each heater model is offered with combinations of thyratron power control, built-in output transformer, or tapped-tank coil resulting in flexibility and adaptability to a wide variety of induction heating loads and applications.

Additional features are dustproof cabinets, separate aluminum enclosures for oscillator units. Filament-

voltage is regulated with constant voltage transformer giving longer tube life.

Voltage regulation of oscillator and rectifier tube filaments maintains voltage within plus or minus 3 percent of rated value when the induction heaters are operated at specified line voltage.

Protective devices include overload relay in high-voltage d-c plate supply, fused control circuit, time-delay relay for tube warm-up, water-flow interlock switch, over-temperature interlock switch, and interlocked access doors which help protect the operator from high voltage.

Oscillator tube and tank circuit is water-cooled, while terminals of the oscillator tube and base of rectifier tube are cooled by blowers.

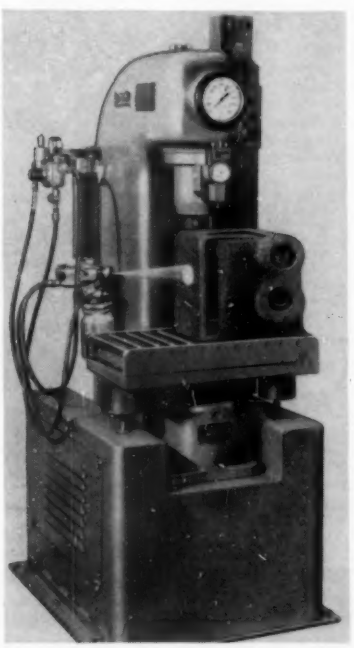
General Electric Co., Industrial Heating Dept., Schenectady 5, N. Y.

T-2-1571

Hardness Tester

Design of a new Brinell hardness tester incorporates a paint spray attachment synchronized with the testing cycle of the machine so that relative hardness of parts is automatically indicated by a spot of paint. Sorting of pieces is in effect done by the machine rather than by the operator.

The tester is designed to fit directly into a roller conveyor supplied by the customer. Castings from the foundry are rough ground top and bottom to remove most of the scale and then are rolled into place on the roller section



Decision at SPS

STANDARD PRESSED STEEL CO. JENKINTOWN, PENNA.

A moment of decision . . . after months of trial, weeks of conference.

It's ADAMAS again

It's ADAMAS . . . again . . . and it's no surprise that Adamas tungsten carbide is specified at SPS . . . for Adamas tungsten carbide products are subject to the world's most rigid set of quality control procedures. Careful selection of materials lies at the heart of quality control at SPS. And, at SPS, where carbide is called upon for use in a great variety of applications, Adamas tungsten carbide is a logical choice . . . for there's an Adamas carbide grade for every job.

Standard Pressed Steel Company of Jenkintown, Pennsylvania is the world's largest manufacturer of Socket Screw Products, Cap Screws, Set Screws and a variety of other threaded fasteners. These SPS products are used on aircraft, home appliances, business machines, in fact, wherever products or components must be held together.
A continuing program of reseach and development at SPS assures a lasting place for the Company in America's future.

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Balancing Machines

with "Speed Button" Control!

Just press the button . . . and read amount and location of out-of-balance immediately on the HI-MAX spirit level! "Speed Button" reduces operator fatique, increases work output. Handles pieces up to 60" in diameter. Ideal for FANS • FLYWHEELS • IMPELLERS • GRINDING WHEELS • COUPLINGS • SHEAVES • PUMPS • CLUTCHES • BRAKE DRUMS • MANY OTHERS. Write for Bulletin 292SB.

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DYNAMOMETERS • BALANCING MACHINES
DRILLING MACHINES

6411 River Parkway, Dept. TE, Milwaukee 13, Wis.
INTERNATIONAL DIVISION—DUMMANN WORLD TRADE CO., Milwaukee 6, Wisconsin, U.S.A.

INDICATE A-2-158-1

of the Brinell tester. The operator locates the part by means of a stop, and manually depresses the cycle start button to start the hydraulic cycle of the machine. The Brinell ball descends to the casting, makes an impression and, if the part is acceptable from the standpoint of hardness, a spot of paint is automatically sprayed onto the casting. Following the test, casting is moved down the conveyor to the next operation. At the end of the conveyor, castings are sorted. Those that are not sprayed are sent to the heat-treating department while those which have been marked are sent on for machining.

Brinell limits on the machine are completely adjustable in accordance with the user's requirements. While the machine shown is a single-purpose unit in that the vertical opening is fixed, other models are available with adjustable openings to handle a variety of work. Spray units can be cycled with acceptable range or can indicate "too hard" or "too soft" specimens.

Steel City Testing Machines, Inc., 8817 Lyndon Ave., Detroit 38, Mich.

T-2-1581

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Cup Wheel Grinder

Light yet powerful, this 6-in. 2000 Series pneumatic cup wheel grinder permits faster, easier work with longer grinder life.

Weighing 10½ lb without guard, the grinder is only 7⅝ in. high. Most of

the weight reduction is because of the magnesium housing and redesigned rotor. Air port leads under the rotor blades assure quick, positive starting.

A large capacity filter screen for the air passage leads over an automatic oiler and oil chamber providing positive lubrication for moving parts, including rotor blades. The governor, with its separate oiler, has a ball type center. It is adjusted through a rotor

NOBLE & STANTON

Standard

JIG & FIXTURE COMPONENTS

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"T" ANGLE PLATES

Our "T" Angle Plates have many applications as milling fixtures, comparator stands or drill jigs. The addition of a few special parts make this a complete fixture at little cost. Normalized, precision-machined castings—7 standard sizes.

BOX JIGS

Standard's Box Jigs are made in either square or rectangular styles in 9 sizes. It will pay you to have them on hand in several sizes.

MILL FIXTURE BASES

Mill Fixture Bases are available in a variety of sizes. All are normalized and precision-machined. They are furnished with either standard keyways, or jig-bored holes for "Sure-Lock" Fixture Keys at no extra cost.

"Sure-Lock" Fixture Keys shown in our catalog

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illustrating our complete line of top quality jig and fixture parts.

AUTOMATION NOTE: Also Custom-Built Precision Parts for Automation Tooling. Ask us.

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INDICATE A-2-158-2

shaft hole, making it unnecessary to take off covers or disassemble the grinder.

The tool can use either the straight type abrasive wheel with the guard attached to the grinder body, or the flanged cup abrasive wheel with the revolving cup guard. The grinder-attached guard is removable without affecting the motor assembly.

Two keys are incorporated in the grinder for balancing and torque transmission; through bolts give compactness and rigidity. A silencer insert has reduced the noise level.

Cleco Div., Reed Roller Bit Co., Houston, Texas. **T-2-1591**

Valve Solenoid and Cover

A solenoid and cover assembly designed and built to JIC standards, for use on certain Ross base-mounted valves, can be applied to three-way and four-way types and to sizes from ¼ through 1¼ in.

The assembly protects the solenoid from dust, splashing liquids and air-

borne contaminants. It can be manually operated without removing the cover and becomes electrically inoperative when the cover is removed.

The new JIC assembly is interchangeable with the standard Ross cover and solenoid units.

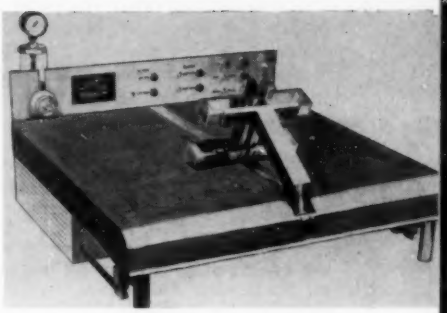
Ross Operating Valve Co., 120 E. Goldengate Ave., Detroit 3, Mich. **T-2-1592**

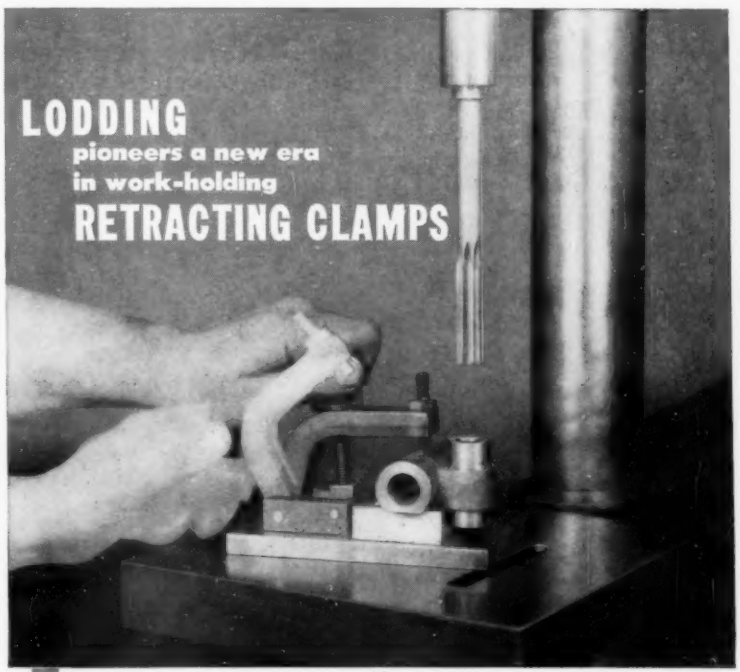
Lead Former, Cutter

Two recently developed component preparation machines provide improved quality control, uniform component position and spacing control.

One is an automatic, high-speed lead former (illustrated) for cutting and forming pigtails on circuit components to desired shapes and specifications. Capable of processing more than 5000 parts per hour, it also is a practical tool to handle short runs because of its quick change features. For example, simply a flip of two toggle switches resets the unit from printed card to terminal board shapes; merely moving a slide changes center distances between loops. The unit is manually fed with option for card, roll or hopper.

The second unit is an automatic high-speed lead cutter. It also may be





For rapid hand clamping. Quick as a flick of the wrist, a quarter turn of the hand knob, and a natural arm movement brings clamp to work and clamps—another quick movement releases work and retracts clamp. Hand knob (shown), cam, nut or air operated assembly. Four sizes each of four styles.

Factory Warehouse
Precision Tool Sales, 417 E. Florence Ave., Los Angeles 3 — PL 3-3321

LODDING, Inc.
WORCESTER 1, MASS.
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hand, card or hopper fed, is easily adjustable to any body size or lead length, and is suitable for large or small runs. A built-in measuring rule to show length of finished leads serves for quick, accurate adjustment.

Design Tool Corp., 80 Washington St., New York 6, N. Y. **T-2-1601**

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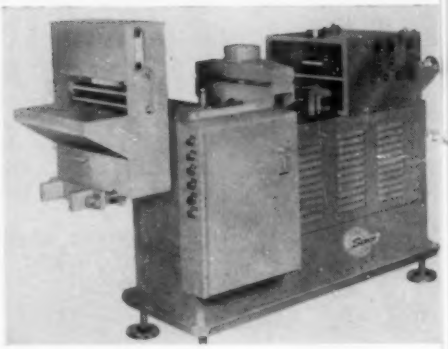
Hydraulic Feed Unit

A hydraulically operated, self-contained unit which can be moved from one press to another, has been developed to feed into the press from the right, left, front or back. It will feed stock of any width up to 20 in. (although it also can be designed to take up to 48 in.) and feeds consistently within 0.003 in. or less of the selected setting. All adjustments are quick and simple. Function of the unit is timed by the stroke of the press ram.



A hydraulic tank assembly serves as the base of the press feed unit and is a reservoir on which the other subassemblies are mounted. The front stock guide keeps the adjustable stock at the proper level, and in line for the desired positioning in the press die. A rear stock guide assembly provides a solid guide and is adjustable to handle stock from a maximum of 48 in. down to a minimum of ½ in. in width. Feed length is adjusted by a conveniently located hand knob.

A gripping mechanism, consisting of a double-action hydraulic cylinder, sequenced with the feed stroke for accurate feeding, provides a pinch grip pressure of up to 6000 lb.

A stock retainer assembly, of the opposed roller type construction, is designed to prevent the stock from slipping backward, on the return stroke of the gripper.

A simple, effective stock oiler satisfactorily oils the stock on both the top and the bottom. A reciprocating pump collects the overflow of oil from the bottom tank and returns it to the upper tank for reuse.

Easy leveling of the unit is assured because of its adjustable floor legs.

Sesco Inc., 8881 Central Ave., Detroit 4, Mich. **T-2-1602**

Stamping Press Control

An electronic "Die Saver" control is easily attached to stamping presses to prevent double heading on nonejected parts and consequent damage to dies and presses. This "Die-Saver" also reduces possibility of accidents, allows faster automatic feeds, increases production, permits one operator to control more than one press, reduces operator fatigue, provides more inspection and stock handling time, and counts only the parts stamped. Easily portable for quick press mounting, this fail-safe control is enclosed in a 6½ x 10½ x 12-in. shock-mounted cabinet.

If ejected parts fail to pass a detection coil, the unit prevents recycling.

NO SPECIALIST required to operate a SENTRY FURNACE

Sentry electric furnaces are designed for the hardening of all types of tungsten, molybdenum and cobalt high speed steel, and for high carbon high chrome steel. (The above profile cutter is an example.) For heat treating these steels, the atmosphere generated by Sentry Furnaces is *truly neutral* as regards scale, carburization or decarburization.

The Sentry Diamond Block Method maintains atmospheric control constantly correct. Continual analysis or regulation by a chemist or metallurgist (so often necessary with other generated furnace atmospheres) is not required by the plant that employs a Sentry Furnace.

Whatever your tool hardening or heat treating needs may be, you can depend on Sentry for reliable, expert quality results every time.

Request Catalog F47

Write

Sentry ELECTRIC FURNACES

THE SENTRY CO. · FOXBORO · MASS.

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It may be used for any stamping application where the press cycle can be made to stop at the top of its travel as it completes 360-deg revolution, or just before the punch enters the lower die. The press must be electrically initiated or it may be converted with a special Robotron kit.

Any type of counting device used with the unit will count only those parts processed, rather than the number of machine cycles.

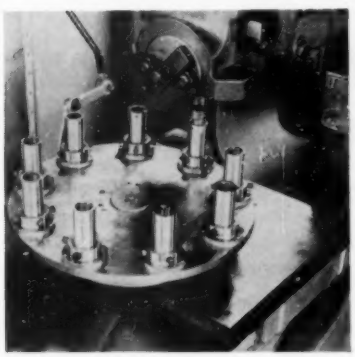
Robotron Corp., 21416 W. 8 Mile Rd., Detroit 19, Mich.

T-2-1611

Rotary Feed Table

Simple design and accurate indexing enables this all-steel rotary feed table to operate with five times the speed ordinarily expected. Because of its engineering, the Meehanite cast index gear wears in. It offers constant accuracy under continuous, heavy-duty operation at high speed.

The table, which may be either me-



chanically or air operated, is available in any diameter from 12 to 36 in., although standard OD is 15 in. Standard index is from 12 to 24 stations. Index gear diameter is 6½; and thickness is 1⅜ in.; over-all height less dial plate is 1¾ in.

Bal-Aero Products Co., 4439 Santa Fe Ave., Los Angeles 58, Calif.

T-2-1612

Automatic Bender

This automatic bending machine produces up to two bends in each end of steel rods at rates up to 960 rods per hour. A mechanically operated rotary drum indexes rods from a feed chute to two bending stations. Inner and outer bends are produced in each rod end by bending dies powered by single-rotation, hydraulic rotary actuators. Finish-bent rods are carried out of the

only 1 adjustable GAGE needed for

. . . A light precision gage with a range of 0" to 6¾"

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GROOVE LOCATION

. . . Checks to either top or bottom of groove.

HOLE DEPTHS

. . . Replaces conventional flush-pin gaging.

SLOT DEPTHS

Models available for checking countersinks.

. . . Gages deep and narrow slot depths.

SPECIAL APPLICATIONS

. . . Adaptable to checking part assembly dimensions.

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"First Choice of Good Inspectors"

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PRECISION GAGING EQUIPMENT

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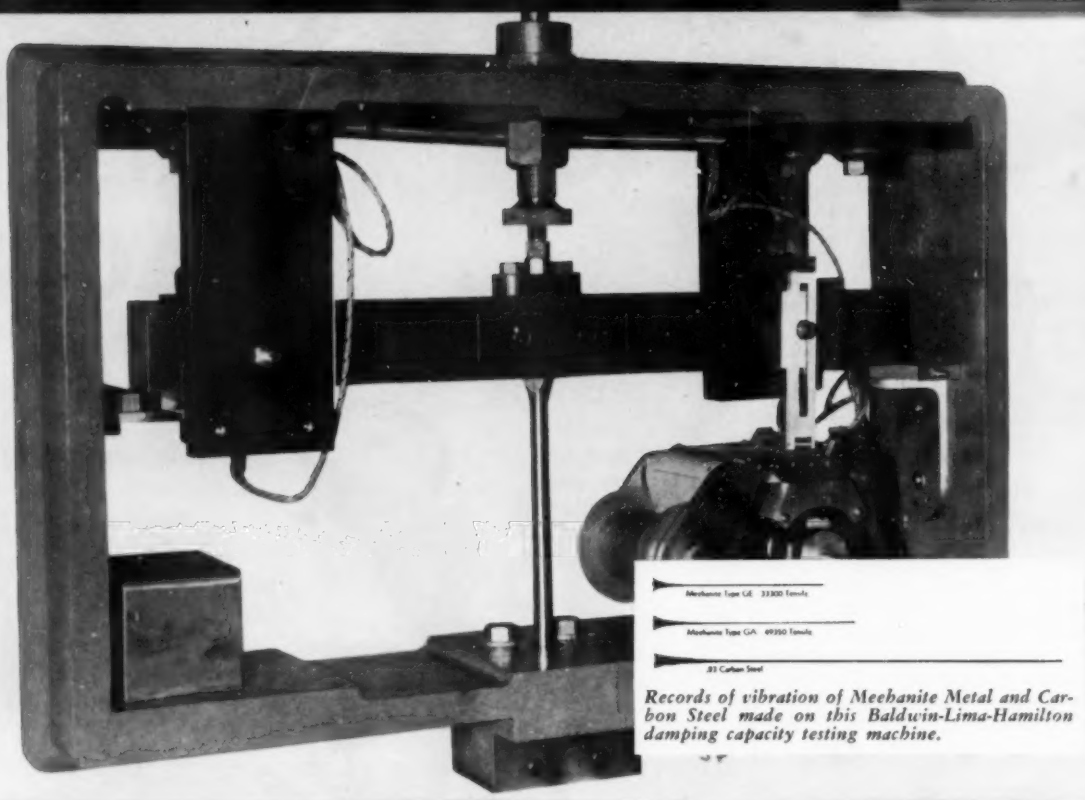
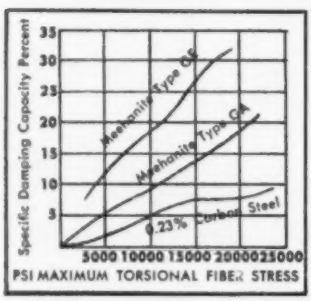


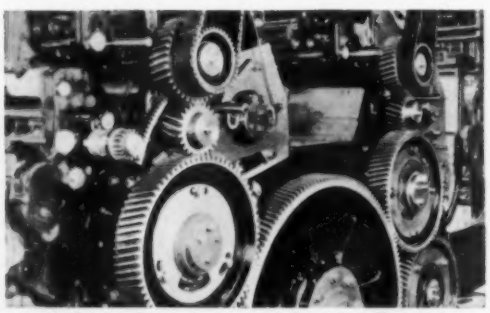
Records of vibration of Meehanite Metal and Carbon Steel made on this Baldwin-Lima-Hamilton damping capacity testing machine.

MEEHANITE CASTINGS POSSESS SUPERIOR VIBRATION DAMPING PROPERTIES AT HIGH STRESS RANGES

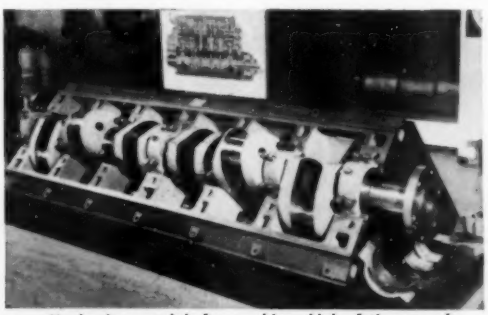


Extreme accuracy in precision machinery and high fatigue life of repeatedly stressed machined parts can be assured with Meehanite Metal castings. Uniform graphite distribution in Meehanite castings provides high damping capacity — 3 times that of steel — (see graph) to absorb built-up stresses due to vibrations. A wholly pearlitic base structure provides the necessary high strength and wear resistance.

Combining the best features of cast iron and steel with other engineered properties, Meehanite castings are uniformly solid and dense, free from defects and readily machinable. *For additional information write to Meehanite Metal Corporation, New Rochelle, New York.*



Meehanite chain of gears and fountain rolls assure perfect register and minimum friction and noise in high speed printing operations.



Meehanite crankshafts combine high fatigue and wear resisting properties with excellent damping qualities that reduce resonant vibrations and provide smoother engine performance.

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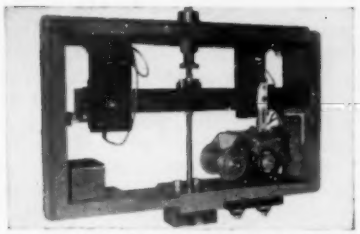

MEEHANITE CASTINGS ARE MADE ONLY BY MEEHANITE FOUNDRIES

The American Laundry Machinery Co., Rochester, N. Y.
Atlas Foundry Co., Detroit, Mich.
Banner Iron Works, St. Louis, Mo.
Barnett Foundry & Machine Co., Irvington and Dover, N. J.
Compton Foundry, Compton, Calif.
Continental Gin Co., Birmingham, Ala.
The Cooper-Bessemer Corp., Mt. Vernon, Ohio and Grove City, Pa.
Crawford & Doherty Foundry Co., Portland, Ore.
DeLaval Steam Turbine Co., Trenton, N. J.
Empire Pattern & Foundry Co., Tulsa, Okla.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Florence Pipe Foundry & Machine Co., Florence, N. J.
Fulton Foundry & Machine Co., Inc., Cleveland, Ohio
General Foundry & Mfg. Co., Flint, Mich.
Georgia Iron Works, Augusta, Ga.
Greenlee Foundry Co., Chicago, Ill.
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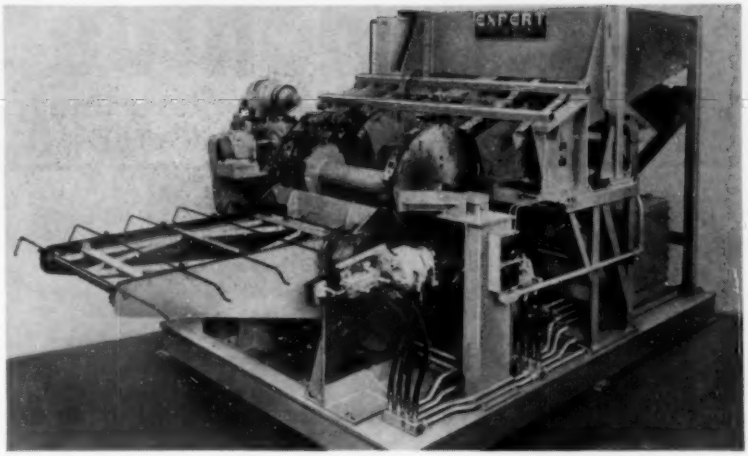


machine by a roller chain conveyor. In operation, the automatic machine cycle is pushbutton controlled.

Adjustable mountings of the rotary actuators permit a wide variety of angles to be produced in each bend, and also allows different plane relationships between the two bends in each rod end. Width of the index drum and machine size depend on the diameter and length of rod stock. Rods to be bent slide by gravity from a feed chute to a position ahead of the drum index.

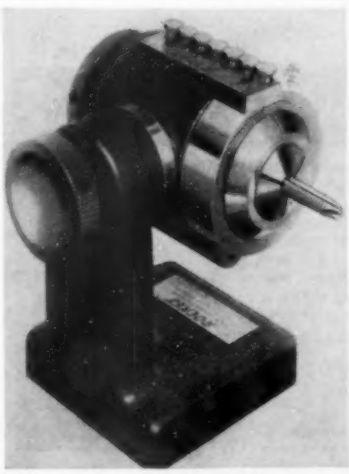
The machine illustrated bends ⅜-in. diam, 5-ft long heat-treated spring steel rods to form automotive trunk lid torsion bars at a rate of 960 rods per hour. Two bends of approximately 90 deg are formed on each end of the rod. One bend has a leg only ¾ in. long.

Expert Automation Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich. **T-2-1631**

Tap Sharpener

An improved model of the Rocket tap sharpener allows greater clearance for the head pivot due to added height of the upright member of the cast-iron base.

Strengthened and improved pushbuttons on the head control indexing or the amount of turn on the tap, while the head itself adjusts quickly from 0 to 90 deg of angle to grinding wheel.



Baked-on black crinkle finish adds to the unit's rust and corrosion resistance.

Designed to resharpen either left or right-hand taps of two, three or four flutes in a matter of minutes, the Rocket tap sharpener can be used on any make or size grinder with a magnetic chuck. Holes may be drilled in base to permit its use on a standard grinder. Equipped with one ½-inch collet, it will accommodate any standard 5-C collet of ⅛ to 1-in. capacity.

Rockford Die & Tool Works, Inc. Rockford, Ill. **T-2-1632**

Thread Inserts

Development of the PIP push insert makes it unnecessary to tap internal threads in a hole to receive a threaded screw or bolt. The new insert is pushed into a straight-sided, plain hole to provide strong, wear resistant female threads in nonstructural parts. Cost is estimated at less than one cent per hole. The hole can be drilled, molded or die cast.

For quantities of up to 1200 per hour, tooling consists of only a PIP mandrel which may be used in any device with a suitable stroke for pushing the insert into the hole. Rotation is not required.

The push insert may be used in any

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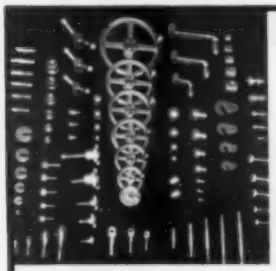

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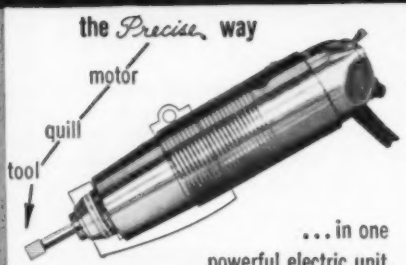

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of the plastics, zinc die castings, permanent mold and sand casting alloys, soft copper base alloys and ferrous metals under some conditions. The PIP insert, manufactured from wire coiled into a helix, differs from standard inserts in several ways. It is tightly wound; adjacent coils are in contact; because it is pushed into the hole, no driving tang is needed; and it has flat surfaces where the coils are in contact so that axial pressure will not cause the coils to slip over each other. The internal threads are standard 60 deg, while external threads are 90 deg.

When the screw is turned into the threads provided by the insert, a run-out thread on the screw automatically wedges the top coil of the insert into the parent material to anchor it. In the case of light metals, a single staking operation, consisting of upsetting the metal around the hole, may be used. The insert also can be installed from the back in the case of through holes with a retaining shoulder.

The PIP push insert is available as standard in copper-clad steel but may be had also in any material which can be formed into wire.

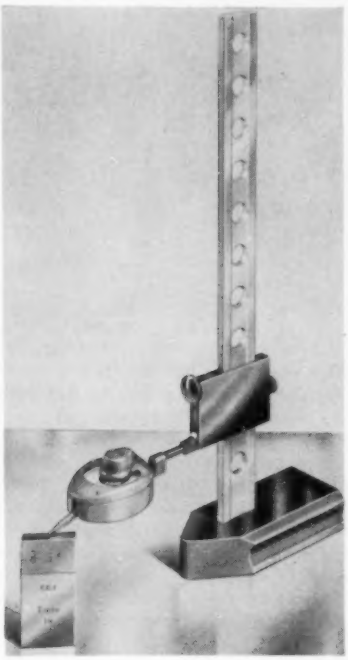
Heli-Coil Corp., Danbury, Conn.
T-2-1641

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Indicator with Height Gage

A height gage has been designed for use with the Minikator comparator to give a high degree of accuracy. Constructed for maximum rigidity, the lapped base is designed to contact the surface plate at the outer edges but is relieved in the center. The center is relieved so that there is essentially no vibration as the gage is moved over a flat surface. The sliding member is perfectly fitted for easy up-and-down movement; and contains a fine adjustment knob for settings of 0.000025 in. quickly and accurately when using the Minikator. Even closer tolerances can be obtained when care is used in splitting graduations.

The Minikator No. 590, for which the gage was developed, is a micro-indicator especially designed for transferring dimensions and measuring in otherwise inaccessible places. It is particularly suitable for indicating out-of-roundness or concentricity of grinding machine spindles, and for locating drilling jigs. The amplification device is mechanical and without friction or slack. Measuring points of two different lengths ⅛-in. diameter



are supplied with the instrument. One point provides measurement range of 0.003 in. with 0.00005-in. dial graduations; the other provides a range of 0.006 in. with 0.0001-in. dial graduations.

C. E. Johansson Gage Co., 10641 Haggerty, Dearborn 1, Mich. **T-2-1651**

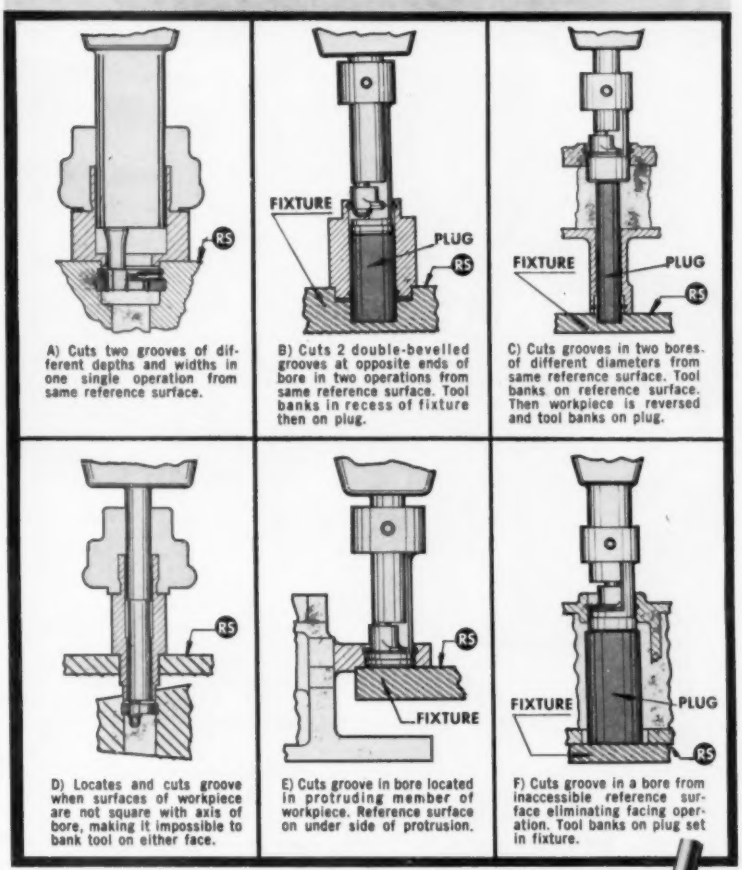
Universal Gear Chucks

Problems of machining or grinding cut gears are simplified through development of a gear chuck that will reference spur and helical gears from their pitch line and insure continued accuracy during machining. It also assures duplication of parts that are machined or ground, and provides unusually easy assembly or interchangeability. It can be used with any of the standard, replaceable jaw type chucks, and can be mechanically, pneumatically or hydraulically operated.

Each Master Spline universal PD (pitch diameter, positive drive) gear chuck is constructed of component parts which are heavy enough in design, and accurately machined to insure accuracy and ease of operation. There are no small parts or gears and any single chuck will handle gears of different diameters within the range of the chuck body.

This master Spline gear chuck is easily adapted to different sizes and to different pitch gears as well as to different makes or construction of chucks. Even when made for a certain

Even Unskilled Labor Can Use This Versatile Tool Accurately! It Simplifies Internal Grooving Problems, Cuts Production Costs!



A) Cuts two grooves of different depths and widths in one single operation from same reference surface.

B) Cuts 2 double-bevelled grooves at opposite ends of bore in two operations from same reference surface. Tool banks in recess of fixture then on plug.

C) Cuts grooves in two bores of different diameters from same reference surface. Tool banks on reference surface. Then workpiece is reversed and tool banks on plug.

D) Locates and cuts groove when surfaces of workpiece are not square with axis of bore, making it impossible to bank tool on either face.

E) Cuts groove in bore located in protruding member of workpiece. Reference surface on under side of protrusion.

F) Cuts groove in a bore from inaccessible reference surface eliminating facing operation. Tool banks on plug set in fixture.

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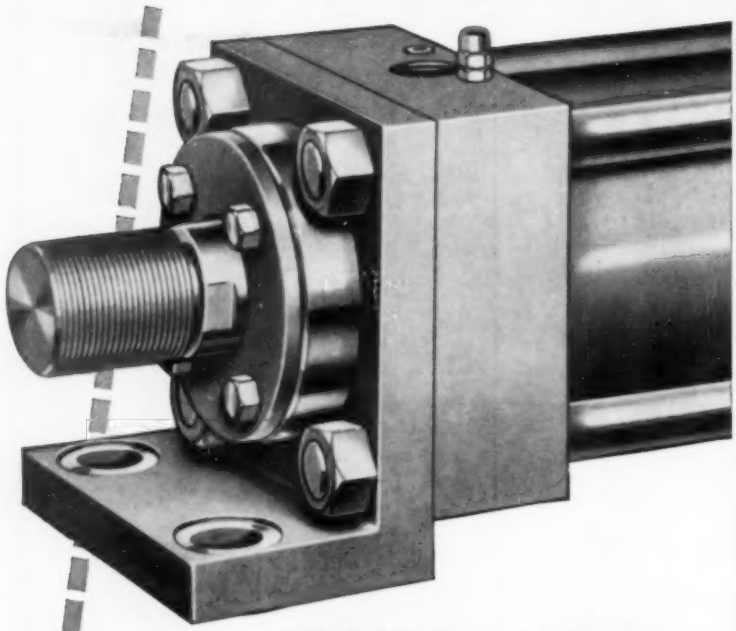

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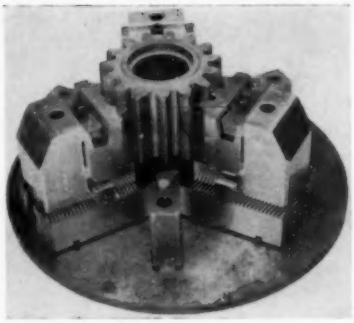

pitch gear it can be used for the entire range of gear sizes within the limits of the chuck body. Gears may have any number of teeth, and with minor adjustments will correctly hold a gear of different number of teeth. When gears of a different pitch are to be machined or ground, only the rack segments of the chuck need be replaced with segments of the proper pitch. Chucks can be either the three or four-jaw type.

Master Spline Tool & Gage Co., 19760 W. Eight Mile Rd., Detroit 19, Mich. **T-2-1661**

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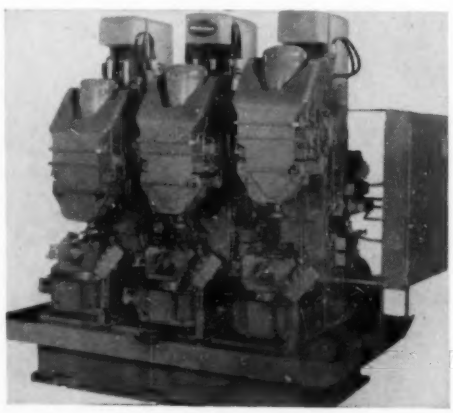
Special Purpose Miller

A specially designed 3-column, triple-head milling finish mills the three slotted lugs on an automotive clutch ring. The unit features three standard Hydro #3 vertical feed units, each equipped with a horizontal cutting tool, and mounted in battery on a single base. Three standard 20-in. hydraulic index tables with three work stations are incorporated on each head. Each index table is cycled to mill in turn each of the three lugs on the



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A-2-244	Allegheny Ludlum Steel Corp.	**Hand Book**—A copy of the Tool Steel Handbook available on request. (Page 244)
A-2-234	American Broach & Machine Co.	**Broaching**—Information on broaching is given in catalog No. 450. Page 234)
A-2-228-2	American Cystoscope Makers, Inc.	**Borescopes**—Booklet on Borescopes available upon request. (Page 228)
A-2-182	B. C. Ames Co.	**Dial Indicators**—Catalog describes the Ames' line. (Page 182)
A-2-46	The Atrax Co.	**Carbide Tools**—88-page catalog of Atrax solid carbide tools. (Page 46)
A-2-257	Axelson Mfg. Co., Division of U. S. Industries, Inc.	**Milling Machines**—Catalogs contain data on Axelson's milling machines. (Page 257)
A-2-148	Baker Brothers, Inc.	**Special Machines**—Catalog available on Baker Basic machines. (Page 148)
A-2-190	Barnes Drill Co.	**Honing Tools**—Honing tools and abrasives are described in catalog 500G. (Page 190)
A-2-224-2	Black Drill Co., Inc.	**Drills**—"Hardsteel" Operators Manual shows how "Hardsteel" drills cut hardened steel without anneal. (Page 224)
A-2-9	The Blanchard Machine Co.	**Grinding Wheel**—Copy of "The Art of Blanchard Surface Grinding" available upon request. (Page 9)
A-2-228-1	Chicago Rivet & Machine Co.	**Automatic Rivet Setter**—Free catalog contains engineering information and rivet specifications plus descriptions of 26 Chicago Automatic Rivet Setters. (Page 228)
A-2-47	Delta Power Tool Division, Rockwell Mfg. Co.	**Band Saw**—Information on the new Delta 14" metal-wood cutting band saw. (Page 47)
A-2-245	The DoALL Co.	**Grinders**—Catalog describes line of hydraulically operated manual or automatic precision surface grinders with modifications and accessories. (Page 245)
A-2-189-2	The Eastern Machine Screw Corp.	**Die Heads**—"Unified and American Screw Thread Digest" discusses insert chaser die heads. (Page 189)
A-2-187	Eastman Kodak Co.	**Cameras**—Book available on "High Speed Motion Picture Making in Industry." (Page 187)
A-2-33	Eastman Kodak Co.	**Optical Gaging**—Booklet on "Projection Gaging with Kodak Contour Projectors" available on request. (Page 33)
A-2-219	The Engelberg Huller Co., Inc.	**Abrasive Belt Grinder**—Information on new Model 680 Multiple-Head, Conveyor-Type Abrasive-Belt Grinder. (Page 219)
A-2-191	Handy & Harman	**Brazing Materials**—Bulletin 20 contains data on Easy-Flo and Sil-Fos silver brazing alloys. (Page 191)
A-2-IFC	The Heald Machine Co.	**Rotary Grinders**—Bulletins 1-161, 1-261 and 2-361-T contain information on Heald rotary grinders. (Inside Front Cover)
A-2-224-1	Hill Machine Co.	**Riveting Machines**—Bulletin "High Speed Production Riveting" contains details and specifications on Hill Machines. (Page 224)
A-2-260	Keller Tool Division, Gardner-Denver Corp.	**Nut Setters**—Bulletin 16-101 contains data on Keller multiple nut setters. (Page 260)
A-2-8	Landis Machine Co.	**Threading Equipment**—Information on Landis Heat-Treated Heads for rotary or stationary applications, straight or tapered threading, available in Bulletin F-90. (Page 8)
A-2-186	Lapeer Mfg. Co.	**Work-Holding Devices**—Information available on line of stationary and portable clamps, pliers and wrenches. (Page 186)
A-2-38	Leland-Gifford Co.	**Drilling Machines**—Bulletins give information on precision drilling. (Page 38)
A-2-150	Lepel High Frequency Laboratories	**Induction Heating**—36-page illustrated catalog contains data on the complete line of induction heating units. (Page 150)
A-2-154	The Lincoln Electric Co.	**Welders**—Bulletin 1343 contains data on production welding with Idealarc-type welders. (Page 154)

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A-2-246-3	Metron Instrument Co.	**Comparators**—Comparator gages described in Bulletin 200. (Page 246)
A-2-173	Micrometrical Mfg. Co.	**Profilometers**—Profilometer Group II with the new type LJ Tracer described in Bulletin LT17. (Page 173)
A-2-164-1	Monroe Engineering Products, Inc.	**Fixture Details**—Line of Monroe fixture details described in catalog. (Page 164)
A-2-BC	The National Acme Co.	**Turning and Forming**—Details on end turning and forming available in Catalog DT-52. (Back Cover)
A-2-37	National Broach & Machine Co.	**Gear Shaving Machine**—Model GCR, Internal Gear Shaving Machine, described in Bulletin S55-6. (Page 37)
A-2-180	C. A. Norgren Co.	**Lubrication**—Blueprint MF-21 gives data on Norgren Micro-Fog Lubrication System. (Page 180)
A-2-151	Oakite Products, Inc.	**Rustripper**—Illustrated booklet describes possibilities of this cleaner, stripper and deruster. (Page 151)
A-2-68	The Ohio Crankshaft Co.	**Induction Heating**—"Typical Results of TOCCO Induction Hardening and Heat Treating" contained in new booklet. (Page 68)
A-2-214	Ortman-Miller Machine Co.	**Hydraulic Cylinders**—Bulletin 105 shows engineering drawings and performance data on the new O-M Heavy Duty Hydraulic Cylinder. (Page 214)
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A-2-32	Rehnberg-Jacobson Mfg. Co.	**Drilling and Tapping**—Manual contains detailed specification sheets for R-J Drill Units, Tap Units and Index Units. (Page 32)
A-2-212	Ring Punch & Die Co.	**Punches and Dies**—For information on Ring Standardized Punches and Dies, request Catalog No. 104. (Page 212)
A-2-259	Rivett Lathe & Grinder, Inc.	**Hydraulic Valves**—Catalogs No. 204 and 260 contain specifications and drawings on Rivett Hydraulic Valves. (Page 259)
A-2-63	The Rotor Tool Co.	**Rotary Tools**—Bulletin 41 contains data on J-2-L impact wrench and other rotary tools. (Page 63)
A-2-160	Sentry Co.	**Heat Treaters**—For information on the Sentry line of heat treaters request Catalog F-47. (Page 160)
A-2-198	Star Cutter Co.	**Drills**—Complete details on the new Starbore carbide drills contained in Data Folder SC-27. (Page 198)
A-2-271	The Thompson Grinder Co.	**Hand Grinder**—Descriptive catalog D-55 contains data on the new Type D Thompson Hand Feed Grinder. (Page 271)
A-2-218	Tomkins-Johnson Co.	**Pneumatic Cylinders**—Bulletin SM-155-2 contains data on T-J Spacemaker Cylinders. (Page 218)
A-2-42	The Torrington Co., Swaging Machine Division	**Swaging Machines**—Booklet on Swaging that gives detailed description of Torrington Rotary Swagers and their capabilities. (Page 42)
A-2-250-3	The Vaill Engineering Co.	**Forming Machines**—New Bulletin T-1 describes the Vaill tube end forming machine. (Page 250)
A-2-62	Vlier Engineering, Inc.	**Swivel Clamps**—Two types of Vlier swivel-pad clamps described in catalog. (Page 62)
A-2-165	Waldes Kohinoor, Inc.	**Grooving Tool**—Ask for manual GT-2-53. (Page 165)
A-2-250-2	West Point Mfg. Co.	**Work-Holding Devices**—Write "New Template" for components of work-holding devices. (Page 250)
A-2-202	Wiedemann Machine Co.	**Turret Punch Press**—Bulletin 101 describes design and operation of small to semi-production lock punch press. (Page 202)

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Write for complete information on any of these instruments to Dept. T-256.

ENGIS EQUIPMENT CO.

431 S. Dearborn St., Chicago 5, Ill.

INDICATE A-2-169-1

clutch ring.

Because all milling on a single clutch ring is done by the same horizontal cutting tool, it is possible to finish mill all three slotted lugs and hold them in the same plane with no degree of variation.

Except for loading and unloading, the equipment is automatic. Designed for one-man operation, it is synchronized so that when one head is down, the other two continue to operate so that the operator can unload and reload each head in successive steps. Production output is 360 clutch rings per hour at 100 percent efficiency.

Michigan Drill Head Co., P. O. Box 4643, Detroit 34, Mich. **T-2-1691**

Pinhole Detector

A redesigned pinhole detector for strip steel offers a sensitivity to detect holes down to one mil diam in opaque cold-rolled strip measuring 10 miles or less in thickness. It will scan strip up to 48 in. wide.

It will function with maximum sensitivity at strip speeds up to 2000 fpm, while laboratory tests indicate a potential in excess of 6000 fpm.

It has h'gh light-source intensity because of 21 small projection lamps, provides an output of more than 25,000 foot-candles and assure uniformity of light.

This great amount of light on the strip makes possible a high sensitivity to angular as well as to vertical holes.

Each tube has a small neon light source which can be energized, making preselection of photo-tubes unnecessary. A sensitivity adjustment is provided on the end of the assembly for each phototube. Consequently, any standard photo-multiplier tube can be used and matched in place with the others. It also provides an easy means of checking each tube while the equipment is in operation.

Detection of a hole is indicated by tripping of a plug-in type relay located in the control panel.

General Electric Co., Schenectady 5, N. Y. **T-2-1692**

Heavy-Duty Lathes

Series 80 heavy-duty engine lathes have been engineered for accurate, high-production turning, boring and facing of large size workpieces. Available in four models and equipped with a Dyna-Shift headstock, they offer automatic calculation of spindle speed to produce the desired surface cutting speed on the workpiece, and a range of 36 different spindle speeds from 8

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smallest size

Reamers

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with L&I

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The Reamer Specialists

LAVALLEE & IDE, INC.

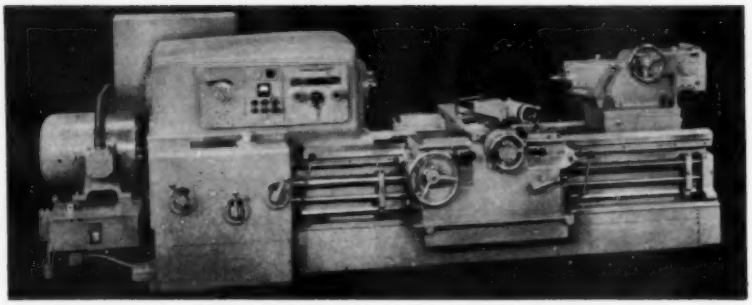
CHICOPEE, MASS.

INDICATE A-2-169-2

to 1000 rpm in models 2000 and 2001, and 10 to 1250 rpm in models 1600 and 1601.

Each Series 80 lathe is equipped with a main drive motor capable of 45 hp.

The Dyna-Shift headstock of the new lathe features two large dials—one for setting the work diameter to be turned, the other for setting the desired surface cutting speed. When these dial adjustments are made and the Dyna-Shift control lever moved to the "Shift" position, the headstock automatically and hydraulically shifts to give the exact spindle speed necessary to produce the desired surface cutting speed.



The gearbox provides a range of 48 commonly used threads and gears, with a range of threads per inch from ½ to 28, including 11½ tpi, and a range of feeds per revolution from 0.003 to 0.168 inch.

A 4-way hydraulic power rapid traverse permits right or left movement of the carriage as well as in-or-out cross slide movement. Controls are arranged so that any one of these movements may be made separately or in a combination of one carriage and one cross slide movement at the same time.

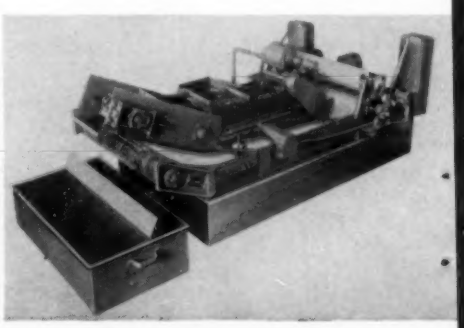
The Monarch Series 80 Dyna-Shift Lathes, Models 1600, 1601, 2000 and 2001, are designed to provide clearance diameters of 25, 30, 32 and 36 inches, respectively. All models are available in standard lengths ranging from 48 to 240 inches between centers.

The Monarch Machine Tool Co., Sidney, Ohio.

Magnetic Separator-Filter

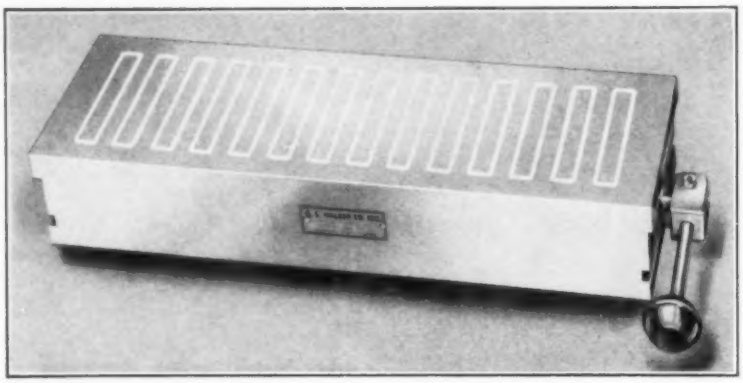
Separation of ferrous sludge and abrasives from coolants can be accomplished by a combined magnetic separator and filter designed to provide 85 to 90 percent more magnetic attraction than previous units.

This unit uses gravity flow of liquids on top of the magnets which gives the



Walker Chucks

You May As Well Have the Best



Pioneer in the making of magnetic chucks, Walker engineers have the know-how to produce chucks that have the proud distinction of being the best in the world.

Walker Permanent Rectangular Chucks are made in nine standard sizes from 4" x 8" to 12" x 24" and larger for special applications.

Walker Rotary Chucks are made in nine sizes from 4" to 16" standard diameter and larger sizes such as 48" diameter, the largest in the world.

Swiveling Chucks are made in three sizes from 4" x 8" to 8" x 24".

O. S. WALKER CO. Inc.

WORCESTER 6, MASSACHUSETTS

Original Designers and Builders of Magnetic Chucks

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-170

benefit of both gravity and magnetic separation. Through efficiency of the magnets in handling the swarf load, the filter size has been reduced while flow capacity has been increased. Smaller size means that from 25 to 50 percent less floor space is required. A prime advantage is the greater swarf load capacity, while operating costs are reduced.

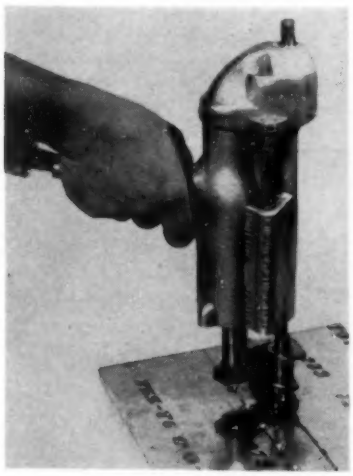
These combined magnetic separating and filter units are continuous, full flow capacity, self cleaning and fully automatic. A tote box with a dividing plate separates the swarf from the used paper.

Industrial Filtration Co., Dept. CM-298, Lebanon, Ind. **T-2-1711**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

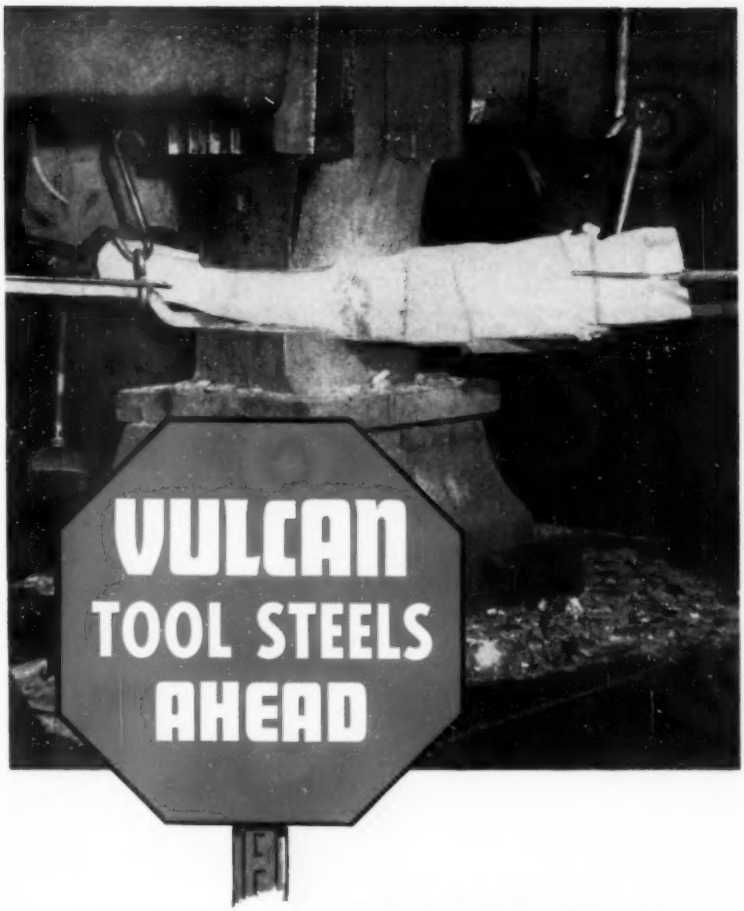
Drill Motor

A fast air-powered hand tool is designed primarily for drilling and countersinking close tolerance holes in a single operation. Spacing feet which can be quickly changed, assure accurately spaced drilled holes without



the use of drill jigs, straps or fixtures.

In operation, the collet in the foot of the Spacematic tool is inserted into a previously drilled hole, and the tool is aligned to the work. When the operator presses the trigger the collet is expanded and drawn, clamping the tool rigidly to the work. The drill is then power fed into the work. In a typical performance, the tool drills ¼-in. diam holes, with a 0.500-in. diam countersink in five seconds through ¾-in. 75 ST aluminum alloy.



in fact...forged to be ahead

Forging has long been recognized as a superior method for producing tool steel billets from ingots. This more thorough working is one of the steps that makes possible tool steels which are capable of maximum toughness and performance. *It helps you produce your finest tool steel products.*

Vulcan forges *all* of its tool steel ingots—carbon to high speed steels—although forging requires greater skill and care. Why not take advantage of this assurance—Vulcan Tool Steel costs no more.

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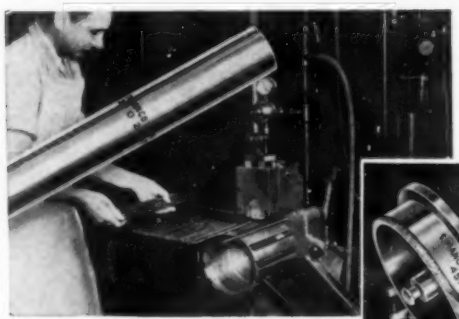
LEADERS IN INDUSTRY MARK WITH NOBLEWEST

How Singer marks best with Noblewest

For half a century, Noblewest has been supply leaders of industry—such as the Singer Manufacturing Company—with precision marking equipment. Singer uses every basic type of Noblewest Roll-O-Matic marking machine to permanently roll-in inscription markings. For faster, money-saving marking in your plant, contact Noble & Westbrook Mfg. Co., 16 Westbrook Street, East Hartford 8, Connecticut.

◀ SERIES 50—Noblewest general purpose marking machine with full pneumatic operation. Can be tooled for marking flat and round surfaces, for precision graduating and for serial numbering with Noblewest automatic numbering heads.

SERIES 20—This rapid precision marking machine will permanently mark up to 5,000 pieces per hour. Ideal for parts that will stand up and rotate on the carrier dial. Three interchangeable pressure dials mark approximately 50 different parts on this one Noblewest machine. ▶



◀ SERIES 19—Has production of 6,000 pieces per hour. The die holder on this model has automatic pressure compensator for insuring uniform depth of markings regardless of slight variation of part sizes.

SERIES 21—A Noblewest rapid production marking machine with a capacity of 2500 to 3500 pieces per hour. Ideal for parts on which markings must be accurately positioned. ▶

MARK IT BEST WITH

NOBLEWEST IMPROVED MARKING DEVICES

NOBLEWEST

ORIGINATORS OF THE ROLL MARKING PROCESS

EQUIPMENT FOR MARKING · GRADUATING · EMBOSSING · NUMBERING

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-172

Adjustments are provided for rate of drill feed and for drill countersink depth. With this tool, an unskilled operator can drill close tolerance holes on a production basis without subsequent reaming operation.

Winslow Product Engineering Corp., 47 St. Joseph St., Arcadia, Calif.

T-2-1721

Large Finger Stops

Five large primary finger stops for use in applications where thick sizes are needed, have now been developed.

A different type of construction permits maintenance of quality and strength, and retention of a competitive price.

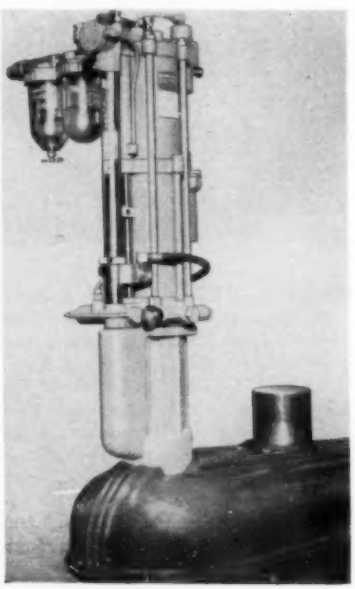
For convenience and quick service, distributors throughout the country are stocking a complete supply of all sizes. Sizes now available of the new finger stops include, 1/8, 5/16, 1/4, 5/16 and 3/8 in.

Applied Mechanics Corp., 462 Lyon. N.E., Grand Rapids, Mich.

T-2-1722

Drill Feed

This drill feed fits on any drill press to permit high production automatic drilling, tapping, reaming, threading, counterboring, spinning, spot-facing, fly-cutting and other operations. Work cycle of air-operated and hydraulically controlled drill feed is started by a foot pedal. Three control knobs adjust all precision operations. One sets a fast approach to any length from 0 to 4 in.; a micrometer type dial controls



drilling depth to an accuracy of plus or minus 0.002; a dial set feed valve adjusts drilling speed to any material hardness. There are no gears in this tool. It does not interfere with manual operation of drill press at any time.

Because there are no electrical devices on this drill feed, it may be operated safely near volatile material. Instant hand and foot pedal release are dual safety features.

General-Pacific Corp., 8740 Washington Blvd., Culver City, Calif. **T-2-1731**

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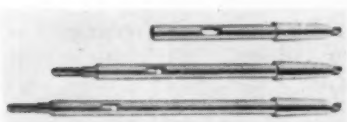
Close Center Tap Drivers

Close center and hard-to-reach tapping operations have been simplified by a line of hardened alloy steel tap drivers and chucks.

The drivers, featuring small body diameters, are available in short, medium and long series, suitable for tapping operations on close centers. For use in pulley tapping or other situations where special length taps are required, close center tap drivers and



chucks may be used with standard hand taps. The body diameter of the driver is only slightly larger than the shank diameter of pulley taps and can be used to replace pulley and special length taps for most applications. The short, medium and long body projections meet most requirements.

This design uses a tap chuck which is split on four sides providing a collet action on the shank of the tap; four-way gripping action provides increased resistance to pull-out. The square on the tap fits into the broached square in the chuck to prevent slipping; shanks of the driver and chuck are tanged to provide a positive drive.

In assembly, the driver and chuck run true within 0.002 in. The chuck closes evenly on all sides and along the length of the tap shank, assuring a true-running tool to avoid bell mouth and oversize tapped holes. Two or more tap chucks may be used in each driver so fewer drivers are required for a complete range of taps.

Scully-Jones and Co., 1901 S. Rockwell St., Chicago 8, Ill. **T-2-1732**

Pressure Gage

A recently developed pressure gage permits available air pressure to be determined at point of use.

This 2-in. diameter gage has a BD-20 hypodermic needle and guard. The fine needle permits tapping the air hose at the tool, thus determining pressure available at the tool regardless of original pressure or number of tools in use.

U. S. Gauge, Div. of American Machine and Metals, Inc., Sellersville, Pa. **T-2-1733**

Die Casting Machines

The Series D line of "expandable" die casting machines is available in capacities of 250, 450, 650 and 850 tons in either hot or cold chamber models. The machines can be furnished as a basic tool equipped with the essentials required for present production. As production requirements change, additional features can be added quickly at the plant location.

A self-compensating knuckled wedge cam toggle arrangement automatically

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MMC MICROMETRICAL MANUFACTURING COMPANY

349 S. MAIN ST. ANN ARBOR, MICHIGAN

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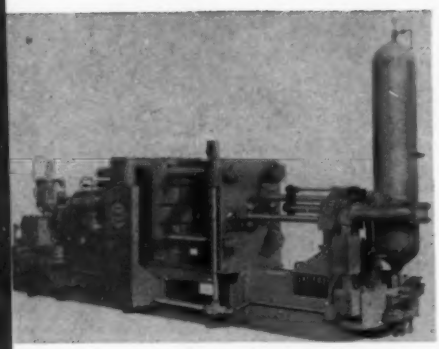

takes up clearances in dies caused by heat expansion. Because of the knuckled joint, there is no shear stress on the pins when under locking pressure.

Improved manifold valving greatly reduces piping and joints. Flexible sequencing corepull valving simplifies changes from one sequence to another.

Furnaces in machines equipped with a hot chamber injection unit can be adjusted from the machine center line to positions below center. A water cooled jacket around the injection cylinder ram reduces packing failure.

Cold chamber units offer injection speeds of approximately 10,000 ipm with pressures of approximately 33,000 psi on the injected metal. The injection cylinder is adjustable from machine center line to positions below center.

Lake Erie Engineering Corp., Box 68, Kenmore Station, Buffalo 17, N. Y. **T-2-1741**

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Thread Broaches

A new line of taps, called Premium thread broaches, is designed to operate at speeds of three to six times the speed normally used for conventional taps while requiring less power. Because of the low power required in their broaching action, they have an unusually long

tool life. They may be resharpened on any tool and cutter grinder without special tools or fixtures.

Particularly economical in operation, these tools feed a solid chip out of the hole being tapped.

The high spiral flutes, apparent in the illustration, are characteristic of Shearcutter thread broaches, to provide about three times more cutting face than standard taps.

Shearcut Tool Co., 7045 Darby Ave., Reseda, Calif. **T-2-1742**

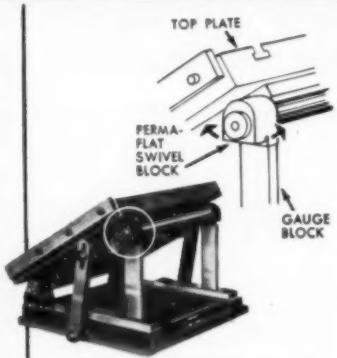
Simplified Switch

A calibrated plate enables visual setting of the new pressure switch C9612 either before or after installation on a pressure line. A tamperproof indicator inside the switch, visible through a window in the plate, can be lined up, by means of an external adjustment screw, with the desired pressure on the plate. Once the desired pressure is set, the screw can be locked in place to avoid accidental disturbance.

This switch is available in four classes which accurately sense any system pressure over an adjustable range of 15 to 3,000 psi. The fixed actuation value varies from 10 to 250

NOW! *First Major Change in Sine Plate Design in 20 Years!*

This exclusive, patented new feature in Robbins Sine Plate design means savings for every tool room! You'll save wear on sine bar rolls and costly gauge blocks, too, with the Robbins "PERMA-FLAT" swivel block, now found on every heavy duty sine plate we manufacture. The PERMA-FLAT swivel block distributes weight evenly over a large area of the gauge blocks on which it rests, rather than with the single line contact obtained using conventional sine bar rolls. Write for complete information on how Robbins Sine Plates save time and add accuracy on all angular machining and inspection set-ups.



Robbins Sine Plates make possible any angular set-up for machining or inspection to gauge block accuracy. Immediate delivery on 12", 24"—36" and 48" square models to order.

OMER E. Robbins COMPANY
24800 PLYMOUTH ROAD DEPT. E-6 DETROIT 39, MICH.
Also producers of special machinery, gages and fixtures

SEE ALL ROBBINS PRODUCTS IN BOOTH 416—ASTE SHOW
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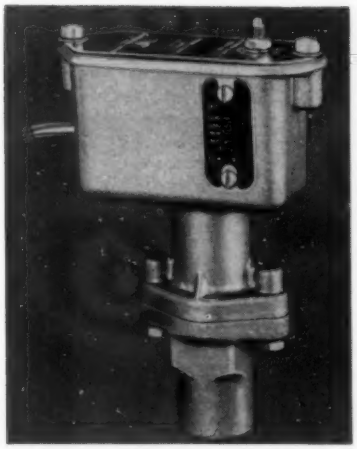

psi, depending on switch setting. The piston type sensing element offers long service life under fast, continuous operation, and is not sensitive to jarring or vibration.

The adaptable mounting bracket for the switch may be rotated to any position on a full circle or moved up and down on the neck of the switch.

Barksdale Valves, 5125 Alcoa Ave., Los Angeles 58, Calif. **T-2-1751**

Low-Temperature Brazing Alloy

This nickel-base brazing alloy allows unusually low brazing temperature, while offering excellent flow and wetting properties, thin to moderate fillet formation and no erosion during brazing. Identified as Nicrobraz No. 10, the new nickel-phosphorous material is recommended for low-temperature joining of metals having a melting point above 1900 F, in applications involving service temperatures from 60 to 1500 F.

Nicrobraz No. 10 powder is easily applied with a suitable brush or applicator after mixing with Nicrobraz cement. With the proper mixture ratio, the new brazing alloy can also be applied by either cold spraying or hot spraying methods.

The alloy is self-fluxing and will flow readily where the atmosphere may be marginal. It can be used in any controlled atmosphere as long as the base metal being brazed remains bright and clean, and does not oxidize. Although normally used in pure dry hydrogen, it also can be applied in dissociated ammonia or combusted city gas atmospheres as well as argon or helium atmospheres.

Recommended brazing temperature for the new alloy is 1850 F. Its useful flow temperature averages approximately 1625 F. Compression shear strength

A TRANSPARENT ALL-CHEMICAL SOLUTION FOR GRINDING

Lusol K-7 is a new all-chemical liquid concentrate designed for a wide variety of grinding operations. It is recommended for use on all steels and is particularly suited for cast and malleable irons, titanium, carbon, rubber, ceramics and plastics. Instantaneously soluable in any water, hard or soft, it forms a clear, transparent, colorless solution that resists contamination, settles chips super-fast, and remains clear after repeated use. It is non-foaming and runs absolutely flat under all conditions. It provides maximum rust protection for all ferrous metals, including cast and malleable irons. It maintains clean wheels at all times. They just don't load up when you use Lusol K-7. For better grinding every time, use Lusol K-7. Write for complete information.

THE Lusol LINE

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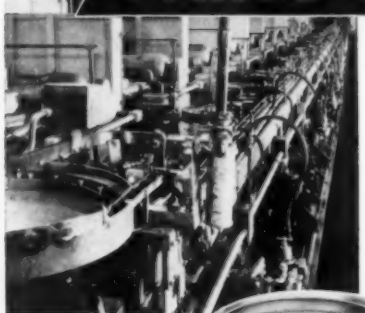
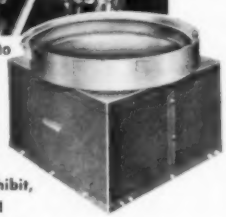
SYNTRON
PARTS FEEDERS



Feeding gear blanks to gear shapers



For Automatic Single-Line Feeding of Small Parts!

Keys, shear pins, gear blanks, stud blanks, tool bits and hundreds of other metal parts are readily handled by SYNTRON Vibrating Parts Feeders — as you want them — where you want them and when you want them.

Parts are oriented and delivered to the usage point one at a time. Controlled feed rate insures delivery of parts at production speed.

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Booth 631
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Complete catalog data—FREE

SYNTRON COMPANY
340 Lexington Ave. Homer City, Pa.

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of a joint brazed with the new substance is at least 45,000 psi.

Standard T-test specimens have sustained 360 deg twist for brazed austenitic stainless steel (304) and more than 720 deg twist for brazed inconel. Tests indicate oxidation resistance to be satisfactory.

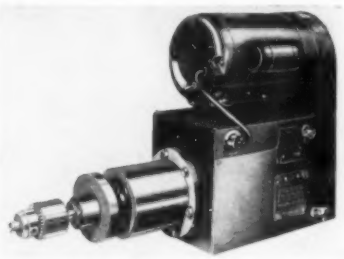
Wall Colmonoy Corp., 19345 John R St., Detroit 3, Mich. **T-2-1761**

Automatic Drilling Unit

Low-cost automatic drilling, reaming, deburring and related operations are possible with the Dumore automatic drill unit Series 26.

Basic electrical and pneumatic controls are built into this unit which is particularly suitable for long production runs and stationary setups or wherever job change-overs are infrequent.

Speeds, feeds and depth can be preselected and require no attention during



operating cycles. A simple nose mounting design enables the unit to be mounted in any position in single or multiple unit setups. It requires 50 to 75 percent less mounting area than is ordinarily necessary.

Motors are available in ⅛ or ½ hp in various voltages, while 10 available pulleys provide a choice of speeds from 400 to 7240 rpm. For chip clearance on deep holes and to get coolant to the drill point, an electronic repeat cycle timer is available that automatically withdraws drill at desired intervals.

Dumore Precision Tools, 1300 Seventeenth St., Racine, Wis. **T-2-1762**

Surface Inspection Equipment

Surface-roughness inspection may be added to automatic production setups with this new equipment which sorts parts, including tapers and parts with grooves or shoulders, in accordance with microinch roughness measured along an OD or flat surface.

The workpieces go from a feed chute

onto a conveyor belt which moves them beneath a profilometer tracer. As the parts leave the tracer, they are automatically directed into an "accept" or "reject" discharge chute in accordance with their roughness. Equipment can be furnished to accept work within only a selected range of roughness, rejecting parts that are either too rough or too smooth.

Each application is engineered to the user's specific requirements, however, each installation for use with external surfaces includes these basic elements: An amplifier, contact meter and a unit made up of a feed chute, conveyor belt, a profilometer tracer, sorting gate and discharge chutes. In addition, possible auxiliary items include equipment for automatic selection of parts to be measured (such as every fifth or tenth part from the production line), signal lights and controls to shut down the line after a given number of parts are rejected.

Micrometrical Mfg. Co., 345 S. Main St., Ann Arbor, Mich. **T-2-1771**

Half Press

This Model B-2-A two-ton half press can be easily adapted for any punching, shearing, forming, riveting, blanking, cutting or drawing operation within rated capacity. It can be used on plastics, textile, paper, leather or fiber in addition to metal. As a half-press unit, it can be mounted on any column and base, and still leave adequate working space. This makes it possible to perform operations which ordinarily would require a much larger press due to the working space involved.

In continuous operation, the Model B-2-A will produce up to 300 pieces per minute. Design includes a single-pin clutch with simple, positive, nonrepeat or repeat action. Straight ram guides with flat gib give accurate fitting of dies for precision stamping. This press is suitable for most types of production or experimental work. Standard stroke is ¾ in. with ¼ to 1½-in. stroke available at an additional charge.

Alva Allen Industries, Clinton, Mo. **T-2-1772**

Bed Type Milling Machine

A new machine, built to include latest refinements in milling practice and design, is called the Mill-M-Matic. The 25-hp spindle motor operates at 1800 rpm. Eighty-one spindle speeds from 25 to 1230 rpm are obtained through change gears, with four speeds per set. Table feeds are 1 to 81 ipm through

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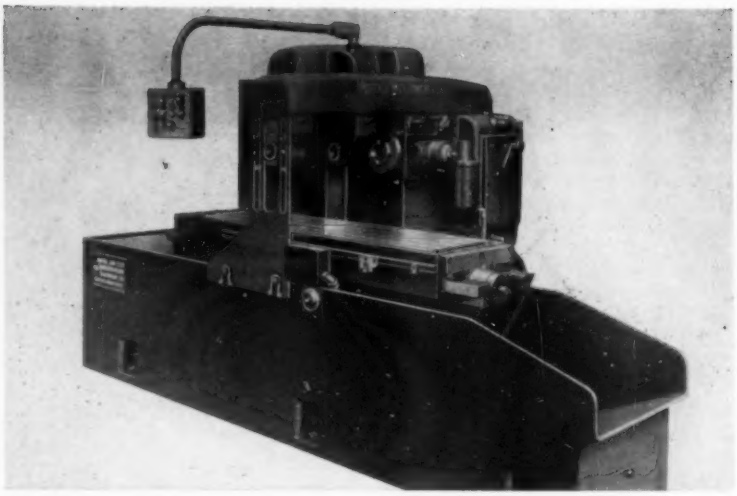
change gears. Rapid traverse of table is 243 ipm.

An involute spline on the spindle efficiently relays power to the spindle regardless of quill position. The quill diameter is 8¼ in. with a total adjustment of 6 in. When fully extended, more of the quill remains in the housing than is extended. An electric brake clutch is mounted on the input shaft for automatic spindle stop. This also serves as a spindle lock for easy tool removal. Automatic quill retraction, resetting and locking can be supplied, as an extra, at the factory or later in the field.

A pendant-mounted push-button station gives the operator full access to controls for convenient machine setup and operation. Several other features have been designed into the unit. The bed ways have been extended beyond the table to avoid excessive overhang of the table at extended positions. The feedbox and table drive mechanisms have automatic force-feed lubrication. Central type coolant and chip disposal systems can be used.



This description fits the plain model Mill-M-Matic, however, the unit also is available in a duplex model.

The Motch & Merryweather Machinery Co., Machinery Mfg. Div., 888 E. 70th St., Cleveland 3, Ohio. **T-2-1781**

The more jobs you watch this rugged new Logan "6560" perform, the more impressive it looks, On the heaviest cuts, or at maximum speed, it turns the work *smoothly*, quietly, with precision results. Superior performance is designed, engineered and built into it.

The Variable Speed Drive provides instant spindle speed correction. The oversize spindle, with 1⅝" bore, turns on a ball bearing mounting that needs no adjustment within the full range of 38 to 1200 rpm. The bed is a wide, deep special alloy casting, extra heavy and resistant to both internal and external stresses. The two V-ways and two flat ways are precision ground. Extra strength and weight throughout, plus dynamic balancing of the complete lathe practically eliminates vibration. Moderate price and low cost operation make the "6560" outstanding in economy as well as in precision performance. Write for Bulletin 14-L, giving a full description.

SPECIFICATIONS AND FEATURES

14½" swing over bed
9" swing over saddle
1⅝" spindle hole
1" collet capacity
40" between centers

Variable Speed Drive
Ball Bearing Spindle
38 to 1200 rpm
Two-V-way, Two-flat way, Precision Ground Bed
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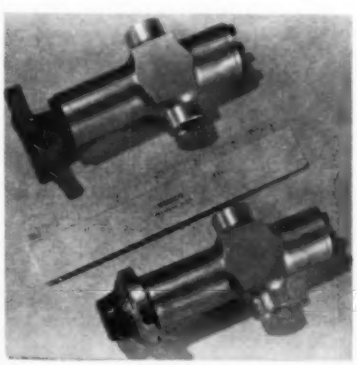
High-Pressure Metering Valve

This valve has been specifically designed for metering or control service over a wide range of flow as well as for use in high-pressure hydraulics. A valve with ⅜-in. tubing ports, for example, will control from drops per minute to 25 gpm at 3000-psi pressure drop across the valve. At 100 psi pressure drop the valve controls from drops per minute to approximately 5 gpm.



Ratios of maximum to minimum controllable flow can be provided up to 100,000:1. Operating pressures up to 3000 psi are standard, although higher pressures can be provided for.

The valve is hydraulically balanced and requires very low turning torque. A fine-thread stem screw is included in order to avoid necessity for tapping the valve handle to make fine adjustments.

A multiturn indicating dial handle can be included to permit rapid setting of the valve to a predetermined position. The repeatability and stability of the valve is such that repeated settings will provide the same throttling.

The basic design permits inclusion of a small electric motor to provide a fully motorized modulating valve. The motorized model includes a miniature electric motor with integral gear reduction, limit switches, relays, and potentiometers for position indication or feedback.

United Hydraulics, Inc., Dayton, Ohio. **T-2-1791**

Coolant for Aluminum

A stain-free coolant recently developed has a high degree of lubricity and detergency, and offers antiweld properties that prevent welding of chips and dust to tools and wheels. The coolant, designated International Compound 131-A, mixes easily with water to form a stable emulsion. It will not discolor aluminum alloys, and produces a good finish, both in appearance and profilometer readings. It does not react with aluminum dust to create unsanitary coolant conditions.

It may be used in large installations involving central cooling systems.

International Chemical Co., Inc., Dept. A 59, 2628 N. Mascher St., Philadelphia 33, Pa. **T-2-1792**

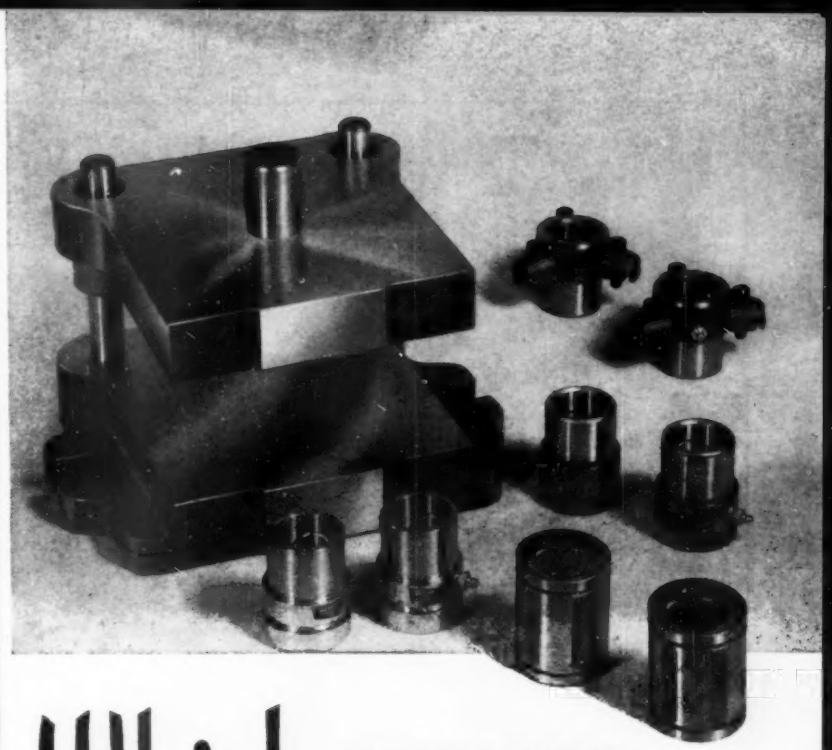
Shaving and Skiving Tools

Two new tools, one for skiving and one for shaving, have been developed for use on either single or multiple spindle automatic machines, or turret lathes.

The shaving tool mounts directly to the cross slide circular tool post of any single or multiple spindle automatic or turret lathe and also is easily mounted on a multispindle machine, where a circular cross slide tool is used.

The shaving tool is designed to hold tolerances of ± 0.0001 to ± 0.00015 in. It is made in standard sizes with a maximum capacity of 2⅜ in. on the larger model, with a range to include the No. 6 Brown & Sharpe. Special sizes are made to order, and carbide tools can replace the high-speed steel cutter normally used.

The companion skiving tool mounts to



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To aid you in bushing selection, we've prepared a bulletin on the subject. Just ask for Bulletin 56, and we'll send your personal copy without delay. Detroit Die Set representatives also will be glad to personally aid you in selecting the right bushings and die sets. They're as near as your 'phone.

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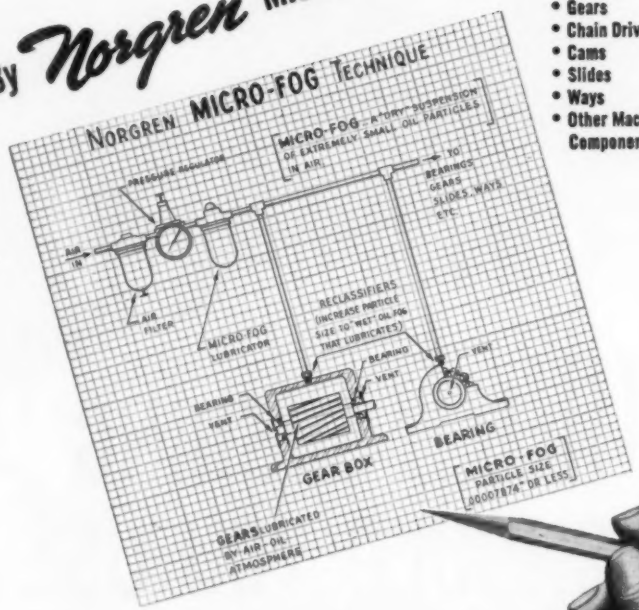
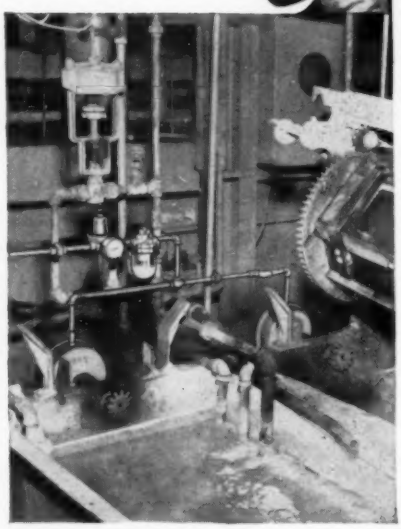


Norgren MICRO-FOG Ends Gear Lubrication Problem On Zinc Plating Tanks

At the Wagner Electric Corp., St. Louis, baskets containing parts to be zinc plated in a hot acid solution are mechanically agitated by a gear drive.

With the former drip feed lubrication method, acid fumes entered the gear boxes, contaminating the lubricant and destroying the gear box seals. Loss of lubricant plus corrosion by the contaminated lubricant greatly accelerated gear wear and resulted in frequent costly repairs.

Three years ago, the Norgren MICRO-FOG Lubrication System at right was installed. The gears are constantly protected from wear by a film of oil — and entry of acid fumes is prevented by the slight, continuous flow of air through the gear box, venting to the atmosphere. Gear wear and corrosion have been reduced to a minimum.



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the circular cross slide tool post of any automatic which uses a circular form tool.

The skiving holder is designed so it can skive either over or under the work. All fine adjustments are easily made in the same manner as circular form tools.

All direct cutting thrust is toward the tool block. The cutter can easily be removed for sharpening and the tool is never disturbed during replacement. Skiving tools are available in various sizes up to a maximum capacity of 2⅜ in.

The Smith Tool Co., 10607 Meech Ave., Cleveland, Ohio. **T-2-1801**

Duplex Optical Comparator

A duplex type optical comparator, the Model P-5, is designed so that it may be used either as an upright floor model for vertical projection operations or in a horizontal position on any shop bench.

This model provides unusually high-intensity parallel light. The rigid tubular type chassis construction assures permanent alignment of all mechanical and optical components. Large stage work area in combination with a standard 14-in. diam image screen permits use of the instrument on most classes of work.

Accessories available include a pedestal type base as well as a new right-angle type universal coordinate measuring stage equipped with precision dial indicators for continuous measurements. This coordinate measuring stage also can be used in either a horizontal or vertical plane.

Lenses to provide magnifications of 10, 20, 25, 31¼, 50, and 100X are available as standard. Over-all dimensions are length 47 in., height 26 in., width

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INDICATE A-2-181-1

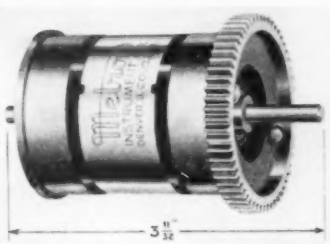
18 in. With pedestal base the complete instrument stands 56 in. high.

Portman Instrument Co., Inc., Town Dock Rd., New Rochelle, N. Y. **T-2-1811**

Miniature Differential

Miniature differentials are now available for applications where small size and long life are essential.

These units will combine two rotating inputs to give speed sums or differences and angular sums or differences. They also will control relative speeds over unusually wide speed ratios, shift phase angles between rotating shafts, and



quickly reverse and change speeds without disconnecting the power source.

Thirty-four different ratios, ranging from 1:1 to 27:1, provide wide design possibilities. Hobbed and hardened spur gears give smooth operation. External bearing surfaces are of brass so the unit mounts readily in bushings.

Units with an internal antibacklash feature, which prevents backlash in most cases, are available.

Metron Instrument Co., 432 Lincoln St., Denver 3, Colo. **T-2-1812**

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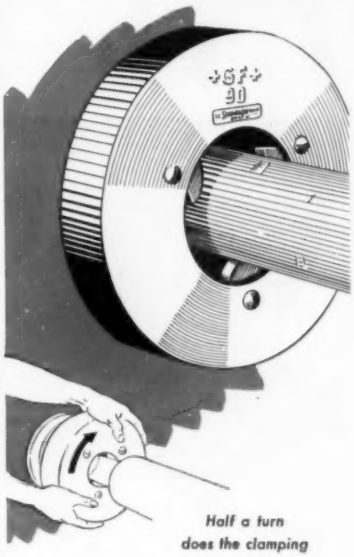
High-Speed Cutoff Unit

A low-priced cutoff machine, the Model M-35-A, offers clean power cutting of ferrous and nonferrous materials at a rate of less than 4 seconds per square inch.

Feature of the machine is an adjustable swivel head for angle cutting up to 45 deg in either direction, left or right. Abrasive wheels for ferrous cutting and steel saw blades for nonferrous cutting are available in either 12 or 14-in. sizes.

Maximum ferrous capacity is 1½-in. solids, 2½-in. standard pipe and 2½ in. structurals. Nonferrous capaci-

SKINNER +GF+ WORK DRIVERS



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+GF+ Work Drivers drive smooth or rough bars and forgings located on centers. Jaws are easily reversed to accommodate direction of spindle rotation.

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ty is 2½-in. solids and 3-in. tubing and extrusion.

A 3½-hp geared-in-head induction type motor operating at 3450 rpm powers this positive drive cutoff machine. Wheel spindle speed is 3150 rpm. The unit has a 1-in. arbor. Work support height from floor to 24½ x 27½-in. table top is 38½ in. It requires only 30 x 40-in. floor space. Equipment includes wrenches and one pair of 3¾-in. wheel flanges.

Stone Machinery Co., Inc., Manlius, N. Y. **T-2-1821**

Boring Bar

This new boring bar reduces bending or bar deflection while making deeper cuts with heavier feeds.

Constructed of both steel and tungsten carbide, the new bar approaches a solid carbide boring bar in stiffness, but possesses greater strength and resistance to failure under excessive forces of impact.

For high strength, three tungsten carbide strips are brazed into slots running lengthwise in the steel bar circumference, extending to the portion of the bar subjected to greatest bending stresses.

When the carbide strips are brazed in place, differences in thermal coefficients of expansion cause the carbide to be preloaded in compression. Tensile stresses developed as a result

of outside bending forces are held to a minimum value.

During tests, the new boring bar shows resistance to deflection or bending equal to twice that of a plain steel boring bar. Break tests indicate unusually high strength.

Currently, composite boring bars are available in standard sizes ranging from $\frac{3}{8}$ to $1\frac{1}{2}$ in. in diameter, designed to use tool bits of high-speed steel, carbide or cast alloys. Bars also are manufactured with special shanks or in multidiameters to bore two different diameters simultaneously.

Cyma Corp., 3581 Kipling Ave., Berkley, Mich. **T-2-1831**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Powered Form Reliever

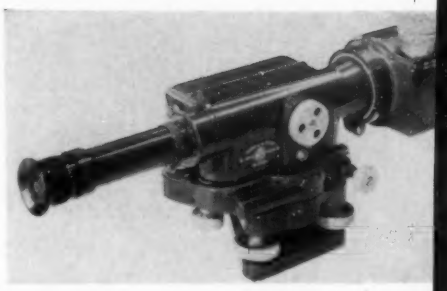
The R-O universal form relieving fixture has been developed in a motorized model for tool grinding departments where a quantity of tools of a single design are ground at one time.

Power operation of the fixture provides speed, while the compact drive has been engineered to deliver a constant high-torque output at any speed from 0 to 80 rpm to produce grinds equal or better in quality than hand grinding.

A $\frac{1}{15}$-hp 1725-rpm reducer motor is used with a 40:1 gear ratio. Besides speed and convenience, the tool tends to prolong tool life from 60 to 200 percent.

Royal Oak Tool & Machine Co., 29800 Stephenson Hwy., Royal Oak, Mich. **T-2-1832**

Level for Optical Tooling



The Microptic Level B131A Mark III, designed for performance suitable for optical tooling, offers unusually easy setup and use for precision leveling.

Its construction makes final leveling accuracy independent of the care with which the base has been leveled, which is done quickly to the conveniently located and fully protected circular

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MACHINE SCREW TAPS SIZES 3 to 10

You don't have to pay a premium for a tolerance you don't need!

While the Revised Screw Thread Standards are a boon to the former users of precision ground (.0005" tolerance) machine screw taps, they definitely discriminate against the manufacturer whose product does not require close tolerance thread fits, *forcing you to pay a heavy penalty for an unwanted tolerance.*

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not only are available in the Ground Thread (.0005") tolerances **but are still offered in the former Commercial Ground (.001") tolerances at savings from 6% to 20%.**

Here's how it works:

You have a part to be tapped with a 3-48 tap, fit desired: Class 2B. By specifying our GH-12 (Basic to +.001") Spiral point tap at a cost of $1.33 instead of a GH-2 at $1.60 YOU SAVE A PENALTY OF 20%, yet easily obtain the desired class fit.

This is a good time to *check up on your machine screw tap prices,* so we urge you to

Mail coupon today for our detailed Price List, which not only explains clearly the many savings on Machine Screw Taps but also shows *attractive quantity discounts available on all Crōmclad Taps.*

Priced no higher than conventional ground thread high speed taps, they carry an unconditional guarantee to perform to your satisfaction or they may be returned for full credit.

*Crōmclad Taps have a special hard chrome surface treatment (less than .00005" thick) developed by us specifically for taps.

NEW ENGLAND TAP COMPANY, INC. **1 Endicott St., Norwood, Mass.**

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bubble. Final leveling is done through a fine graduated screw, operating from a pivot at the instrument's center.

The split, precision bubble and prismatic reading system are fully protected and are mounted integral with the sighting telescope. The eyepiece is fully erecting and of new and improved design. The optical micrometer has a range of 0.250 in., reading to 0.001 in.; pointing accuracy is 0.002 in. in 100 feet.

Service and sales representatives in the United States are Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill. **T-2-1841**

Milling Cutter

This milling cutter is designed to hog metal, and to take heavier cuts than conventional tools.

The development is possible because friction and heat have been greatly reduced. Staggered serrations on each cutting flute serve to break chips into small particles. It is this chip-breaking

principle which allows the tool to cut freely even on unusually heavy cuts, almost without vibration or chatter. The chip-breaking feature also is particularly valuable in side-milling operations and in the hogging of pockets.

Although this cutter, which is made of Swedish tungsten and cobalt alloys, is designed to increase rough cutting speeds, it will produce a fairly finished cut.

It is manufactured in ½, ¾, 1, 1¼, 1½ and 2-in. diameters.

Precision Industrial Tools (P.O. Drawer 352), Libertyville, Ill. **T-2-1842**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Universal Work Clamp

This universal, helix type work clamp developed by Deckel, is a complete, permanent unit that provides economical and reliable clamping action on all types of workpieces. With it, there is no need for separate work clamps, blocks, bolts, nuts and washers to hold odd shapes, cylinders, bores, sheet-metal parts or hollow bodies.

Simply moving the adjustable support moves the clamp to any desired height along the small helical steps

which extend around the axis of the clamping bolt.

The slotted clamp, fitted into a groove on top of the support, permits the clamping force to be exerted close to the workpiece. For greater flexibility the clamp can be turned 180 deg so that either the flat or the L-shaped end can be used.

Eleven different sizes are available: six sizes for 7/16 or 9/16-in. wide T-slots with minimum clamping height of 0 to 1¾ in. to a maximum of 7 1/16 to 10 in.; five sizes for 11/16 and 13/16-in. wide T-slots with minimum clamping height of 0 to 2¾ in. to a maximum of 7⅞ to 12⅝ in.

Sold by Cosa Corp., 405 Lexington Ave., New York 17, N. Y. **T-2-1851**

Permanent Dry Lubrication

A permanent and dry lubrication process, particularly useful where ordinary oils and greases are not feasible or desirable, and where parts must function without failure, is available for applications on all metallic surfaces.

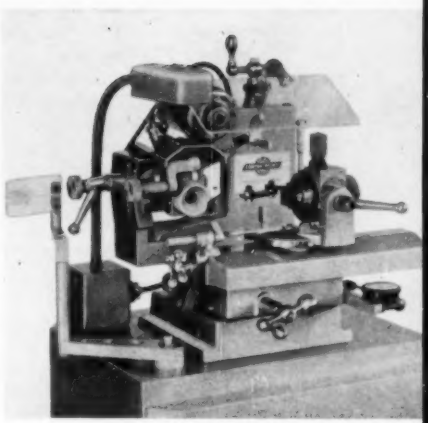
This USECO-Lube impregnates and film coats a surface and leaves no surface build-up. Impregnation into the metal pores assures the presence of the lubricant even after prolonged wear. This feature provides permanent lubrication to a part regardless of size or shape. Oxidation, corrosion and friction are greatly reduced and sticking is prevented. With it, too, effective lubrication is provided at temperatures ranging from −30 to 800 F.

U. S. Engineering Co., 14550 Lesure Ave., Detroit 27, Mich. **T-2-1852**

Grinder for End Mills

The Centra-Point grinder for end mills and other small tools features a simplified method for grinding helical cutters. It is so designed that only a few simple adjustments set the machine up for work in less than half the time ordinarily required. In sharpening tool steel or carbide cutters, the operator merely checks recommended machine settings according to the machine's manual, attaches the proper tooth rest and the setup is complete. Clearance angles can be read directly from calibrations on the wheel head assembly, without reference to tables of constants. Mechanical wheel dressing by built-in diamond truing tools assures exact wheel radius for helical grinding.

Collet capacity of the machine is up to ¾-in. diam; largest cutter which can be accommodated is 3-in. diam. The grinding wheel, which operates at 6900 rpm, is 2 in. in diam. Work head swivel



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METAL SLITTING SAWS
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CUT OFF SAWS • CIRCULAR KNIVES & ROTARY SHEAR BLADES • CIRCOLOY-STEEL SAWS • SOLID & TIPPED TUNGSTEN CARBIDE SAWS
COMBINED DRILLS & COUNTERSINKS • CENTER REAMERS
CIRCULAR TOOL CO., INC.
PROVIDENCE 5, RHODE ISLAND
Specialists in Circular Cutting Tools Since 1923
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scale ranges from 0 to 90 deg, while the clearance angle scale is graduated from 15 deg up to 15 deg down. Carriage travel is 4 in. The indexing mechanism accommodates 1, 2, 3, 4, 6 or 12 teeth. It will grind up to No. 7 B & S taper or up to No. 2 Morse taper.

William H. Field, Inc., 325 Dorchester Ave., Boston 27, Mass. **T-2-1861**

Stud Stamper

Specifically designed to imprint ends of studs or solid cylindrical parts automatically, this machine stamps pieces at rates from 1,000 to 2,000 per hour. Studs may be marked on one end or on both simultaneously.

An adjustable chute to which parts are fed will accommodate sizes from ½ to 1½-in. diameters, by 3 to 12 in. long. Parts are positioned between lettering tools by means of a spider, which locates and holds them, while the ram in the tailstock makes the identification. After marking, spider resumes rotation, ejecting parts into discharge chute.

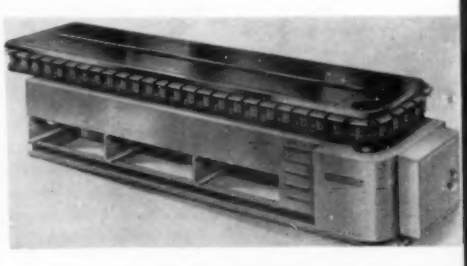
A pneumatic cylinder operating at from 60 to 100 psi, depending on marking requirements, provides power to make the impression. Production speed is adjustable by means of a handwheel; ram speed is electrically timed to spider speed.

Geo. T. Schmidt, Inc., 1810 Belle Plaine Ave., Chicago 13, Ill. **T-2-1862**

Transfer Unit

A transfer-type basic machine chassis in a wide range of standard models has been added to the series of standard indexing units.

This straight-line type indexing chassis, called Auto-Tran, provides a standard unit for application to both automatic and semiautomatic assembly operations. It is designed with accessible faces for mounting various types of operational devices for drilling, tapping, staking, etc. Hopper feeders may



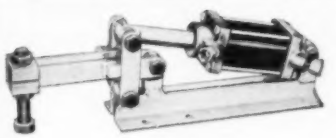
HEAVY-DUTY AIR (or Oil) CLAMPS

Never send a boy TO DO A MAN'S JOB

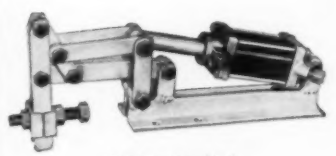
If you are developing a fixture to hold an automobile panel or other large assembly, it's a good idea to have the clamps rated to the job they're expected to do. In other words, never send a boy to do a man's job!

You can get husky, heavy-duty clamps from Lapeer—clamps which are built to stand up under the knocks and abuses of busy production lines. These clamps are air or oil operated—designed to grab tightly, let go quickly. Failure of air or oil pressure will not release the clamps, thus eliminating the possibility of scrappage.

Pictured are just two of several heavy-duty models available.



AO—400 (HD)



AODT—400 (HD)
Double-Toggle Type

SEND FOR OUR CATALOG NOW!

Manufacturers of a complete line of Stationary and Portable Clamps and Pliers

KNU-VISE PRODUCTS LAPEER MANUFACTURING CO.

3053 DAVISON ROAD • LAPEER, MICHIGAN

WESTERN DIVISION: 422 Magnolia, Glendale, California • CANADIAN DIVISION: Higginson Engr., Hamilton, Ontario

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-186

be mounted in any position around the chassis.

The Auto-Tran unit is offered with 48 to 72 carriers; 3, 6, 9 or 12-in. index travel, and with either vertical or horizontal mounting surfaces on the carriers.

Feature of the equipment is the cam indexing unit which provides smooth operation; drive is through a sprocket incorporating a pin clutch which means convenient disengagement and easy alignment of operational devices and tooling.

Swanson Tool & Machine Products, Erie, Pa. **T-2-1871**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Magnetic Plate Clamp

A recently developed magnetic plate clamp is being marketed under the trade name of Bux. It may be used for fabrication of metal plates without jigs, dogs, mechanical clamps, fixtures and similar items.

Only 21 in. in over-all height, and approximately 50 lb in weight, this tool generates 3000 lb of holding power,

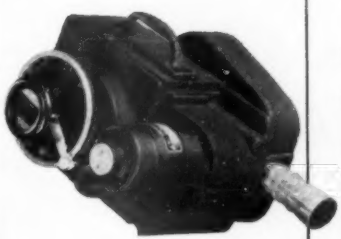
and can be instantly attached to or removed from the job. The Bux plate clamp may, for example, be used to pull edges of heavy steel plates flush and hold them in position for butt welding. A simple one-piece leverage rod and pressure stud are mounted on a swivel at a convenient fulcrum point enabling one operator to perform lap welding easily. Leverage control forces the metal surfaces into proper contact for efficient welding conditions and minimizes any buckling of the plates.

Because the rectifier unit is contained in the post, external convertor units are unnecessary.

Buck Mfg., 100 Roberts Rd., Los Gatos, Calif. **T-2-1872**

To label and package drugs for safe, effective use . . .

SHARP & DOHME needs good packaging machinery . . .



and this is the camera that helps them design it

It's the camera that has helped John Deere build a better beet harvester, Firestone make a safer tire, A. B. Dick meet a tight production schedule, Friden figure faster, Michigan Tool roll and sell a better spline.

The Kodak High Speed Camera does this by taking up to 3200 pictures a second on 16mm movie film. Projecting the film at normal speed slows down parts moving too fast for human eyes to follow—slows the action down as much as 200 times to a highly detailed crawl on the screen. The cause of trouble and often the cure stick out like a sore thumb.

Can the Kodak High Speed Camera solve problems for you? Find out by sending for a copy of the booklet, "High Speed Motion Picture Making in Industry."

EASTMAN KODAK COMPANY
Rochester 4, N. Y.

the Kodak *HIGH SPEED* Camera

Kodak

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Trade Literature

For Free Booklets and Catalogs—Convenient Request Card on Page 167

Silicones

Twelve-page 1956 reference guide to 150 of this company's most commonly used silicone products, grouped by physical form such as fluids, compounds, greases, etc., and cross-indexed by usage; includes product descriptions and pertinent data; illustrated with charts, tables, graphs and application photographs. Dow Corning Corp., Midland, Mich. **L-2-1**

Cast Aluminum Alloys

Illustrated booklet, "How to Melt and Cast Aluminum Alloys" written by product development director Frank J. Daniels, covers proper pouring temperatures, how to minimize drossing, how to degas the metal, how to avoid air entrapment, gating and risering practices etc. Metallurgical Dept., The George Sall Metals Co., Inc., 2300 E. Butler St., Philadelphia 37, Pa. **L-2-2**

ARMSTRONG
Quality TOOLS
ARMSTRONG TOOL HOLDERS
Permanent, multi-purpose tools, for every operation on Lathes, Planers, Slotters and Shapers.
ARMSTRONG HIGH SPEED
Ready-to-grind Bits Ready-ground Cutters
ARMALOY Cast Alloy CUTTER-BITS
ARMIDE Carbide-Tipped CUTTERS
6 cutter shapes, 12 sizes—2 grades of hardness
ARMSTRONG BORING TOOLS
6 types with boring bars in sizes for all boring and internal threading work. Hold cutters at 90°, 45° and 30°
ARMSTRONG THREADING TOOLS
have high speed steel form cutters, require only top grinding to resharpen. Hold true thread form. Rigid and "Spring" types.
ARMSTRONG Drop Forged DOGS
Lathe Dogs, Milling Machine Dogs, and Clamp Dogs. 12 types, all sizes.
ARMSTRONG Drop Forged "C" CLAMPS
Heavy Duty, Medium Service, Deep Throat, and Tool Makers' types in all sizes. Also drop forged Machinists' Clamps.
ARMSTRONG Setting Up Tools
A complete line of Drop Forged Strap Clamps, Planer and Bracing Jacks and T-slot Bolts.
ARMSTRONG Drop Forged Eye Bolts
Plain or shoulder pattern. Blank or Threaded. 14 sizes. Drop Forged and heat treated.
ARMSTRONG Ratchet Drills
All steel wearing parts hardened. Packer, Railroad, Standard, and Short types, both plain and reversible.
ARMSTRONG Drop Forged Wrenches
Both Carbon and Alloy Steel. Over 100 types in all sizes. Improved designs, steels, and heat treating give greater strength.
ARMSTRONG Detachable Socket Wrenches
All sizes and types with driving handles, extensions, and drop forged ratchets. Sold singly or in cased sets.
ARMSTRONG Machine Shop Specialties
Drill Drifts, Tool Posts, Drill Holders, Cutter Grinding Holders, and Tool Makers' Vises.
ARMSTRONG BROS.
Better Pipe Tools. A complete line, each a better tool with hardened, alloy or drop forged parts wherever they will add to strength or tool life.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5257 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

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Made-to-Order Metals

Facilities for production and processing of made-to-order metals in experimental quantities are described in 16-page illustrated booklet "Precision Metals Services." Allied Products Div., Hamilton Watch Co., Lancaster, Pa. **L-2-3**

Grinding

Photos and descriptions of integrated production lines, automatic grinders and standard machines presented in 20-page illustrated brochure dealing with company's precision cylindrical grinding machines; sketches of various operations serve to clarify discussions. Landis Tool Co., Waynesboro, Pa. **L-2-4**

Springs

Preliminary design data for company's Flex'ator compression spring presented in 16-page engineering bulletin; covers characteristics and properties, materials, types of ends, methods of mounting, design formulae and design standards; illustrated by drawings, graphs and charts. Flex'ator Div., Hunter Spring Co., Lansdale, Pa. **L-2-5**

Shell Molding

Cold process shell Speedmullors and other units for shell sand preparation and shell molding are described in detail in illustrated catalog; also covers Formatic shell molding machines, Blomatic shell blowing machines and the Cormatic shell core blowing machines, and discusses advantages and limitations of each process. Beardsley & Piper, Div. Pettibone Mulliken Corp., 2424 N. Cicero Ave., Chicago 39, Ill. **L-2-6**

Stainless Fasteners

Fifty-two page data book gives illustrations, thread and size specifications and availability in various corrosion resistant metals of 40 basic fastening devices; thumb indexed for quick reference. Second part of book offers engineering data relating to composition, properties, applications and weights of stainless steels, plus tables of information pertinent to fasteners. Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, L. I., N. Y. **L-2-7**

Surface Grinders

Well illustrated 24-page catalog presents broad variety of precision surface grinders for toolroom and production grinding describing construction and pointing out design features and advantages; includes specifications; special section discusses crush form grinding and its applications; also covers attachments and accessories for equipment. The DoAll Co., Des Plaines, Ill. **L-2-8**

V-Belts

Care and maintenance of industrial V-belts discussed in 14-page illustrated manual; topics include designing new drives, double matching, belt installation, how V-belts grip, importance of tension, drive alignment, cleaning instructions; also includes a V-belt service chart listing causes of belt failure and outlining preventative measures. The B. F. Goodrich Co. Industrial Products Div., Akron, Ohio. **L-2-9**

Aluminum Bronzes

Basic information on properties, composition and functions of aluminum bronze alloys offered in 32-page booklet, "W W Premium Quality Aluminum Bronzes"; includes complete engineering data plus a specification index chart to identify W W grades with various government and technical societies' specifications; also contains drawings and tables of machining recommendations, information on engineering and metallurgical consultation services. W W Alloys Inc., 11725 Cloverdale Ave., Detroit 4, Mich. **L-2-10**

Drilling, Tapping

Illustrated 4-page Bulletin 170 on 4F heavy duty drilling and tapping machines describes design features and advantages. Edlund Machinery Co., Cortland, N. Y. **L-2-11**

Grinding Wheels

"How to Select Grinding Tools for Precision Grinding, Tool and Construction Steels" presents reprints of three articles that appeared earlier in company's magazine "Grits and Grinds;" articles, written by Norton grinding engineer Clifton C. Nickerson, are illustrated with photos and charts to clarify points in text. Norton Co., Worcester 6, Mass. **L-2-12**

Gears

Pocket-size Catalog #8 covers line of fine pitch nylon, phenolic and helical gears available from stock. PIC Design Corp., 160 Atlantic Ave., Lynbrook, L. I., N. Y. **L-2-13**

Get Into Production Quicker On Every Job

Buck AJUST-TRU® AIR CHUCKS

Hardened Key Ways Standard Feature

Hardened key ways of the Buck, combined with hardened jaws, let you run thousands more pieces (holding tolerances within .001") than conventional chucks.

You can save from several minutes to many hours on every set-up for your chucking machines with the Buck Ajust-Tru power chuck.

Jaws can be machined in the tool room—and hardened if you wish—since there is no need for extra machining to fit jaws to the work. Final accuracy adjustments are made by the chuck . . . *in a matter of minutes* . . . holding work under full air pressure!

Jobs can be run intermittently *without re-truing jaws.* On new runs and re-runs accuracy within .001" is guaranteed. Write for full details today.

Buck Air Chucks are made in 6", 8", 10", 12" diameters—2 or 3 jaws. NO PRICE PREMIUM.

BUCK TOOL COMPANY
233 SCHIPPERS LANE • KALAMAZOO, MICH.

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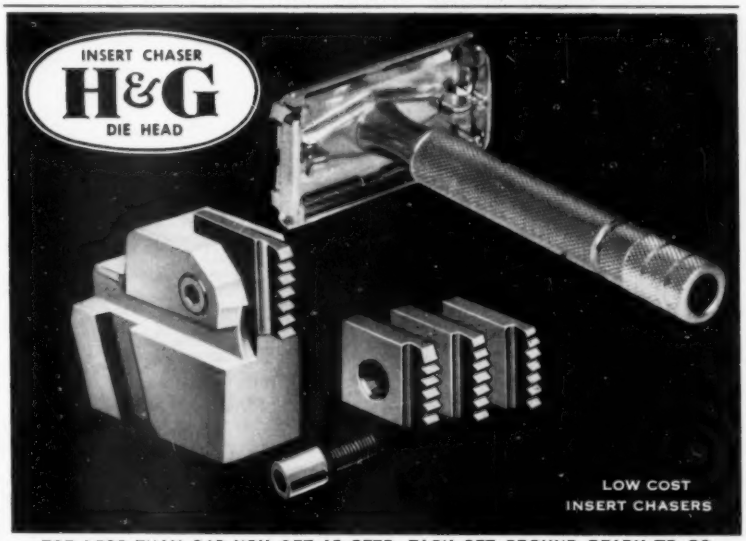


FOR LESS THAN $40 YOU GET 12 SETS, EACH SET GROUND READY TO GO

Men would not accept either idea at first . . .

INSERT CHASERS SAVE UP TO 33%

Insert chasers are like safety razor blades: they cost so little that you can throw them away when dull. Or, for utmost economy, you can resharpen them over and over again. Only a flash grind is required. For less than $40 you get a dozen sets of ¾–16 insert chasers, each set ground ready to go. You will be amazed at the quantity of threads they will cut, even to Class 3 specifications, with a minimum of downtime. FREE: "Unified and American Screw Thread Digest"

THE EASTERN MACHINE SCREW CORPORATION 27-47 Barclay St., New Haven, Conn.

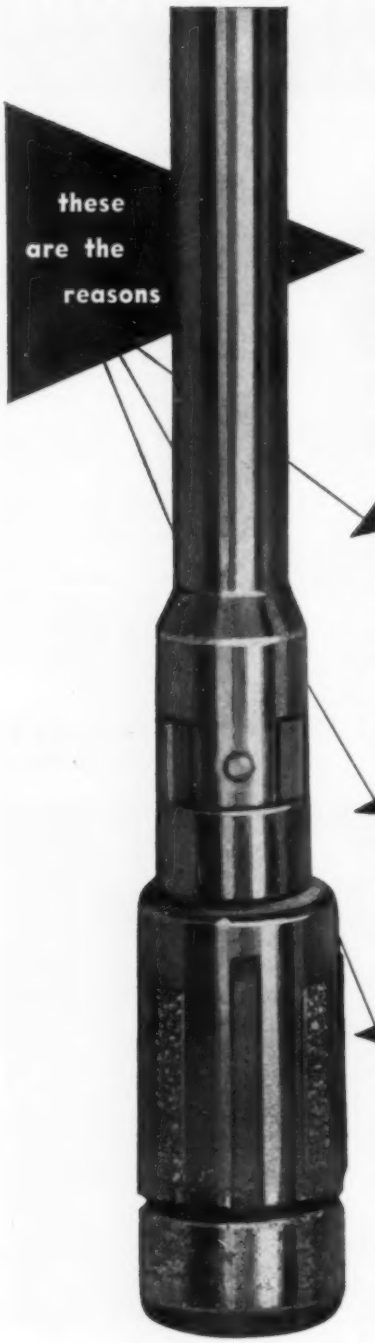
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-189-2

these are the reasons

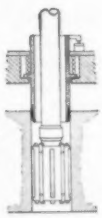
BARNESDRIL

HONING TOOLS AND ABRASIVES

provide greater productive life — and lower stone costs!



Plugmatic Sizing
The Plugmatic Gauging Member directly sizes the bore being honed. Gauge is self-aligning and not affected by misalignment or eccentric stone wear. Bore-to-Bore accuracy is guaranteed within "tenths".



Electronic Feed Control
Electronic feed control operates automatically to maintain proper pressure between stone and work surface at all times. Adjusts automatically to compensate for stone wear, and keeps honing operation at peak efficiency.

"Extra Deep" Plas-T-Clad Stones
Patented BarnesdriL mounting provides up to 300% more usable stone life, with greater support closer to the cutting edge. Freer cutting action results, with longer abrasive life and less downtime for replacement. Quick-loading stone mount simplifies changing stones.

Conventional

BarnesdriL

Write For Catalog 500G

BARNES DRILL CO.

870 CHESTNUT STREET • ROCKFORD, ILL.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-190

Carbide Tools

Sixty-four page Catalog No. CC covers recent developments and additions to line of carbide drills and cutting tools; listings include specifications, illustrations, and helpful technical information. Request on company letterhead directly from Union Twist Drill Co., Dept. CNR, Athol, Mass.

Carbides

Four-page booklet, "Adamas Tungsten Carbide Grades," describes complete line of tungsten carbide grades; four sections deal with straight carbide grades for machining cast iron, nonferrous and nonmetallic materials, steel cutting carbide grades, carbides for die applications and special purpose grades; includes physical and chemical data, chemical analysis of some Adamas materials, and a selector guide for users. Dept. F-42, Adamas Carbide Corp., Kenilworth, N. J. **L-2-14**

Heat Dissipation in Hydraulics

Eight-page Bulletin 90030, "Heat, Its Generation and Natural Dissipation in Hydraulic Circuits," by company's development engineer, J. K. Douglas, offers pertinent information regarding heat transfer area, oil circulation rate, auxiliary pumps, power pumps and pipes and valves, including charted test results; useful to those interested in engineering, installation and operation of fluid power. The Oilgear Co., 1599C W. Pierce St., Milwaukee 4, Wis. **L-2-15**

Gage Blocks

Extensively illustrated with photos, drawings and charts, 36-page Catalog No. 56 offers detailed descriptions of line of linear and angular gage blocks and accessories, optical flats, interferometers and temperature meters; includes discussion of method of measuring, and also a section on care and handling of measuring equipment; tab indexed for quick reference. Weber Gage Co., 12912 Triskett Rd., Cleveland 11, Ohio. **L-2-16**

Carbide Tools

Illustrated 36-page booklet covers line of carbide tipped and solid carbide drills, reamers, end mills and counterbores; with each listing there are suggestions on proper selection of tools plus a table of sizes, prices, flute lengths and overall lengths. Booklet also includes pertinent technical information about use and care of carbide tools. The Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio. **L-2-17**

Hydraulic Presses

Twenty-four page Bulletin No. 1010-C illustrates and describes line of hydraulic metalworking presses for drawing and forming, straightening, forcing, bending, reducing, hobbing etc., pointing out important design features and advantages; includes discussion of Elmes' pipless hydraulic circuit. American Steel Foundries, Elmes Engineering Div., 1150 Tennessee Ave., Cincinnati 29, Ohio. **L-2-18**

Wire Rolling

Details on wide range of 2-high wire flattening mills and auxiliary equipment presented in illustrated 12-page booklet No. 731-R showing extensive variety of the line and pointing out special features of custom engineering for specific applications. Waterbury Farrel Foundry & Machine Co., Waterbury, Conn. **L-2-19**

Adjustable Taps

Extensively illustrated 8-page Bulletin G-92-2 presents details about line of solid adjustable taps; covers special features, advantages, uses, specifications and applications. Landis Machine Co., Waynesboro, Pa. **L-2-20**

Cutting Speeds

Wall chart shows proper cutting speeds to use with various surface speeds for aluminum stock in automatic screw machines; data covers surface speeds from 50 to 1000 fpm for stock diameters ranging from $\frac{1}{8}$ through 5 in. Chart also illustrates proper tool angles to be used with aluminum in automatic screw machines. Kaiser Aluminum & Chemical Corp., Industrial Service Div.-PR 155, 1924 Broadway, Oakland 12, Calif. **L-2-21**

Nickel-Plated Steel

Twelve-page manual presents technical description of company's lectroclad nickel-plated products; covers manufacturing techniques and fabrication procedures, including forming, welding, cleaning, handling and testing methods. The Colorado Fuel & Iron Corp., 575 Madison Ave., New York 22, N. Y. **L-2-22**

Grinders

Extensively illustrated 16-page brochure covers design, construction, and special features and advantages of new 2H30 precision horizontal double spindle disk grinder; includes specifications. Request on company letterhead directly from Gardner Machine Co., Beloit, Wis.

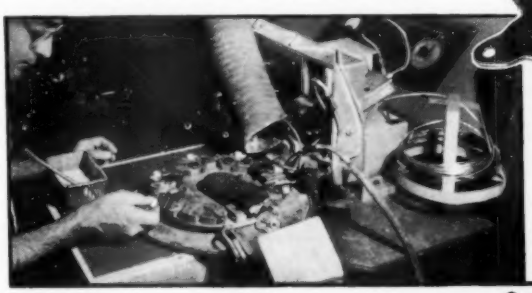
EASY-FLO brazed construction

the ☆EASY... ☆FAST... ☆LOW-COST WAY...

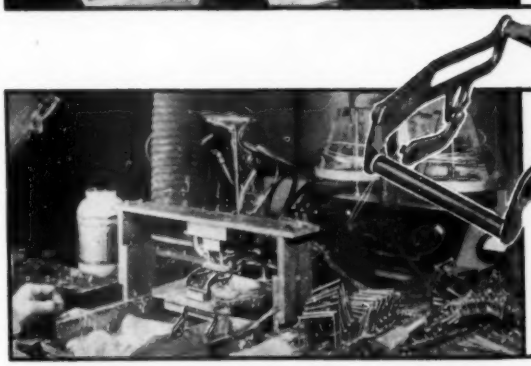
...TO MAKE PARTS LIKE THESE...

Thousands of small parts are now made of stampings and screw machine parts joined with the low-temperature silver brazing alloy EASY-FLO. This construction provides one-piece strength and is surprisingly economical – especially when a production setup is used that *automationizes* the actual brazing.

Victor Adding Machine Co., Chicago, makes quite a few parts the EASY-FLO brazed construction way. Here you see some typical examples.



Bushing is induction brazed to case hardened stamping on turntable fixture with EASY-FLO 45 wire automatically fed and positioned at joints. Operator merely loads parts. Time per assembly – 3½ seconds – 500 per hour.



Frame above is made by brazing side pieces to rods on induction coil setup shown. Output of 120 frames (480 joints) per hour is easily maintained. At left – a few other parts similarly produced.

Expert brazing production know-how at your call

To users of EASY-FLO and SIL-FOS silver brazing alloys, and to designers and production men considering their use, we offer full cooperation in working out joint designs and fast production procedures. Ask for a field engineer to call.

For full EASY-FLO and SIL-FOS facts in print **write today for Bulletin 20.**

HANDY & HARMAN

General Offices: 82 Fulton St., New York 38, N. Y.

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There's no "...or equal" for EASY-FLO and SIL-FOS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-191

Technical Shorts...

METAL BEARING and cutting surfaces are being provided with a hard, long-wearing armor coating as a result of a new process called Armoloy. It has been undergoing operating tests at Fort Worth Steel & Machinery Co. which recently acquired the process and processing plant in Fort Worth from The Armoloy Co. Tests indicate that a major advantage from its use is reduced down time for replacement of cutting tools with consequent over-all increase in plant production capacity.

Develop Process For Hard Coating Metal Surfaces

A multistage precision process involving electrodeposition, Armoloy can be applied to practically any point where friction occurs between metals. Rigid control provides a finish on surfaces' specified dimensions.

Results of specific experiments indicated that a two-thirds saving in maintenance and replacement of hobs was effected by Armaloy. Hobs previously had to be resharpened after 3 to 3½ hours of sprocket-cutting. Then, about two hours of grinding was necessary to restore the cutting edge. Treated hobs have worked up to 23½ hours without need for resharpening. In other instances, life of bandsaw blades was increased from two to four times, while the life of taps was increased from two to three times.

* * *

SIX PATENT applications covering an automatic lead cladding machine have been granted to American Viscose Corp. and Knapp Mills, Inc. Output of the machine is calculated to meet a demand for metal products with the strength of steel and the shielding properties of lead. Such a demand has grown out of the rapid expansion of the nuclear industries. In operation, the unit creates a homogenous bond between steel and lead, giving the finished product the desired strength plus the ability to shield against the escape of harmful rays from nuclear reactors.

Automatic Lead Cladding For Steel

Although handmade lead clad steel is commonly used in chemical and process industries, the new automatic cladder will make its production faster and more efficient.

Experimental work with lead clad steel has been done successfully on atomic submarines, airplanes, locomotives and ships. Knapp Mills, Inc. is the world-wide licensee of all American Viscose inventions relating to lead.

* * *

TESTS MADE on a high-strength, vacuum melted super alloy 1570 recently created by engineers of Carboloy Dept., General Electric Co., indicates promise of its successful use as a sheet material. Although originally developed by G-E Research Laboratory for use as a wrought turbine bucket material for jet aircraft, it appears to have in sheet form strength superior to those currently used for after-burners, tail cones and similar hot parts.

Super Alloy Proves Useful As Sheet

As a further satisfactory characteristic, the alloy tends to lend itself readily to joining by inert arc welding. Both manual and machine tests of inert arc welded 1570 sheets show that tensile and rupture strengths of the joints made from this method are essentially equivalent to base material properties. Ductility exhibited by the welded joints also was considered very good. The alloy is not crack sensitive, and welds as easily as does 321 stainless steel.

MOORE SPECIAL TOOL COMPANY

Holes, Contours, Surfaces

Published in the interests of greater accuracy and quality in the toolroom and on the production line by the Moore Special Tool Co., Inc., 732 Union Ave., Bridgeport 7, Conn., builders of Jig Borers, Jig Grinders, Panto-Crush Wheel Dressers, Precision Rotary Tables, Motorized Centers and a complete line of Hole Location Accessories.

7 Tricks of the Trade in Jig Grinding Small Holes

The following tricks of the trade will prove helpful in jig grinding small holes with a diamond-charged mandrel:

1. Uniformly graded diamond powder should be used for charging mandrels. Holes from minimum (1/64") to about 3/32" in diameter should be roughed and finished with 80-100 grit powder. Larger holes may be roughed somewhat more rapidly with a coarser grade, 60-80 grit.

2. Avoid bellmouth by preventing the mandrel from leaving the hole at either end.

3. Since a freshly charged mandrel will cut much more rapidly than a worn one, avoid introducing a freshly charged tool as a hole nears size, Fig. 1.

4. Do not permit the uncharged *shank* of a mandrel to contact the surface being ground. Frictional heat will burn both the work and the mandrel. The former, partially annealed at point of such contact, will charge with diamond sut and probably be ruined.

5. It is generally more economical and efficient to consider mandrels as expendable and make a new one for each job. Since the cost is only a few cents, use of an old one, or even the time spent trying to match one to requirements, is hardly justified.

6 Because mandrels cannot be trued with a diamond, it is necessary to measure both the top and bottom of a hole while grinding, in order to avoid a ridge.

7. In view of point 6, it is advisable to set the work up on parallels of sufficient height to enable measurement from beneath the workpiece, Fig. 2.

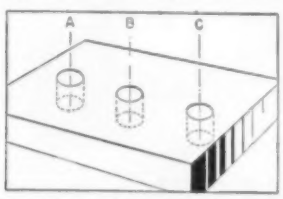

Fig. 1. In grinding three holes to size, A and B are roughed to within .001"—.002", and C within about .005". Using a freshly charged mandrel, C is finished to size, thereby breaking down the high points on the tool. A and B may now be safely ground to size.

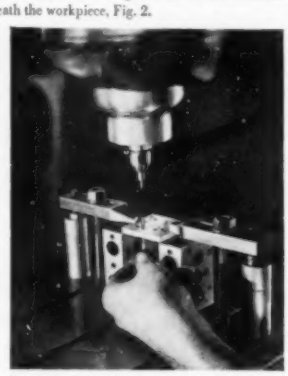

Fig. 2. Workpiece is mounted high enough to permit measuring bottom as well as top of hole.

Get ALL the answers from this new, 424-page book

The information on this page is just a sample of the valuable, on-the-job aid you can get from Moore's *all-new* book, HOLES, CONTOURS AND SURFACES. Tells you how to produce tools, dies and precision parts *the modern way*. 424 pages, 495 illustrations. 184 pages of Woodworth Coordinate Location Tables from 3 to 100 holes. Price only $5 in U.S.A., $6 elsewhere. Send check or money order to Moore Special Tool Co., Inc., 732 Union Ave., Bridgeport 7, Conn.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-192

Field Notes...

University of Illinois' College of Engineering, with the cooperation of the Division of Engineering Extension is offering its ninth annual short course in "Quality Control by Statistical Methods." Dates for the course are March 19 through 29. It will include intensive work in the fields of control charts and acceptance sampling, as well as some information on rational setting of specifications and tolerances. The course is designed for persons in the areas of design, production, procurement, management, quality control and inspection. Details may be obtained from Prof. John A. Henry, Mechanical Engineering Laboratory, University of Illinois, Urbana, Ill.

anniversary

Schneider & Marquard, Inc. is celebrating its 25th year in the tool and die field. In lieu of publishing a commemorative brochure or holding open house to mark the anniversary, Bruno Schneider and Oscar Marquard, founders of the firm, contributed $5,000 to be shared jointly by American Cancer Society and the American Heart Association. This gesture, they felt, could best express both their appreciation and pleasure over reaching this milestone in business.

expansions

First step in an expansion program designed to double its capacity for production of titanium and titanium alloys during this year has been taken by Mallory-Sharon Titanium Corp. with the purchase of the entire Niles Rolling Mill. The Mill's production of steel sheets will not be affected. According to the announcement made by Mallory-Sharon, acquisition of the rolling mill, formerly a division of Sharon Steel Corp., will enable the company to control directly all stages of titanium production from sponge blending through shipment, and will assist in smooth scheduling and uniform quality control. Facilities at Niles now include the titanium melting plant, research laboratory, the newly acquired rolling mill, engineering building and an administration building.

Ford Motor Co. operations in the Cleveland area are currently undergoing an expansion program slated for completion sometime in 1957. First to be completed of the four operations affected by the plan is the Engine Plant No. 2 which recently went into full operation using latest developments in automatic production techniques.

Next on the schedule for completion is the new stamping plant which will be ready early this year. It is designed to utilize automation. In this connection, a completely staffed automation department conceives, designs, constructs, tests and maintains all automation in the plant. The technicians are responsible for finding easier, more efficient methods for the plant's operation. An example of this department's function is the automated welding operation. In this case stampings from two or more lines are conveyed simultaneously into electric welding machines where they are joined into a finished body part.

V V V

Work has started on a new $5,500,000 aluminum extrusion plant for Reynolds Metals Co. in Chesterfield County, near Richmond, Va. The fa-

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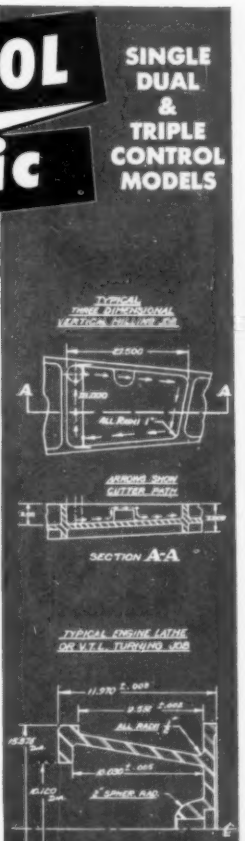

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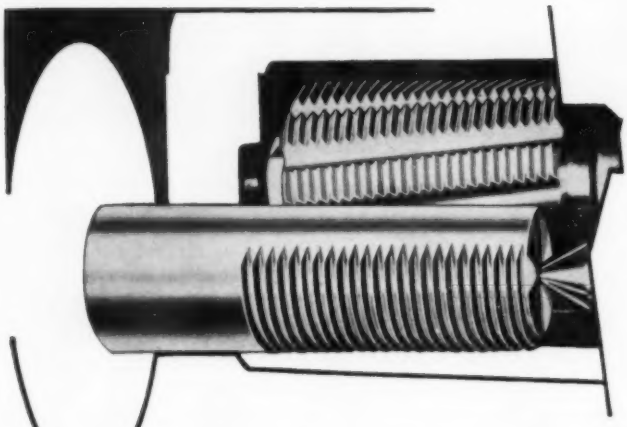

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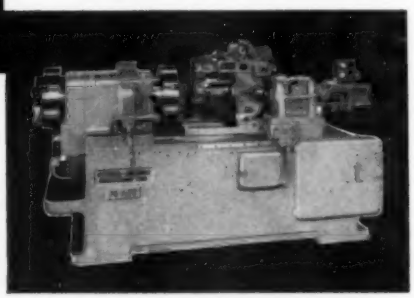

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cility, which is expected to be in production sometime during the third quarter of 1956, will employ about 350 workers.

V V V

Announcement of a $280-million expansion program has been made by Kaiser Aluminum & Chemical Corp. This will bring the company's total primary aluminum capacity up to 654,000 tons per year—or more than 50 percent of its basic capacity. Major projects under the new program will be construction of a 220,000-ton aluminum reduction plant at Ravenswood, W. Va., and a 500,000-ton alumina plant on the Mississippi River near Gramercy, La. Work is to get under way on these facilities by April.

V V V

Second expansion step this year in its New England operations has been announced by Joseph T. Ryerson & Son, Inc. which has entered into agreement to purchase property and inventory of the Wallingford, Conn., plant of Follandsbee Metals Corp. With this acquisition, the company has 17 locations through which it may conduct its steel distribution business.

V V V

A $700,000 plant and facilities expansion program currently is being completed by H. W. Loud Machine Works, Inc. to meet the aircraft industry's demand for greater production. Six automatic duplicating type Cincinnati hydrotels and a 12,699 sq ft building to house them were included in the program. In addition the tool and die department was enlarged so that all production tooling can be completed within the plant.

V V V

An additional 10,000 sq ft have been acquired by Delmonte Plastics Corp., West Coast representative of Plastics Div. of Ciba Co., Inc., for the warehousing of Araldite epoxy resins.

V V V

Physical facilities as well as its engineering, model shop and production capacities of Clegg Laboratories, Inc. have been expanded to three times their previous sizes. Among the modern equipment additions in the production area of the new plant are simplified electronic scanning and audio sensing units for automatic control operations. These units provide reliable unattended observation of machinery or production processes at low cost.

V V V

An extensive expansion program for its Newington, Conn., plant has been launched by The Atrax Co. It includes general enlargement of all production

facilities as well as construction of an additional plant area.

Borg-Warner Corp. has entered into agreement for acquisition of Primor Products, Inc. which will be operated as a Borg-Warner division. The purchasing company has scheduled an expansion for the plant's manufacturing space.

Gorton F. Price, president of Primor, and who will remain with the company in a consulting capacity, has also announced formation of Primore Sales Inc. for the purpose of designing, developing and marketing refrigeration products.

V V V

Plans for a $500,000 addition to its factory at Adrian, Mich. have been made public by American Chain & Cable Co., Inc. It will add about 20,500 sq ft of working space and will cost about $210,000. New equipment to be installed will cost an additional $253,000. Completion is expected early this year.

corporate changes

Walworth Co. has contracted to acquire all outstanding common stock of Conoflow Corp., producer of pneumatic automatic valve control equipment. In exchange, Walworth will issue 53,537 shares of its common stock. This is the fourth major acquisition by Walworth in recent months, made in connection with its planned expansion and diversification program.

V V V

Formal consolidation of Niagara Alkali Co. into Hooker Electrochemical Co. has been completed following stockholders' vote in favor of the merger. Now Niagara Alkali's facilities will be operated as Niagara Alkali Div. of Hooker. J. Clark Cassidy, formerly president of Niagara Alkali, was elected a vice-president and director of Hooker.

warehouses

Vulcan Crucible Steel Co. Div. of H. K. Porter Co., Inc. has opened a new warehouse and sales office at 61 Moulton St., Cambridge, Mass. to increase sales and service facilities in the Boston area. It will carry a full line of Vulcan tool steels and flat ground stock and drill rod. A. Wilfred Nelson is district manager.

V V V

Three new branch warehouses have been opened by the Atkins Saw Div. of Borg-Warner Corp. They are located at 111 N. Des Plaines St., Chicago; 5600 Tulip St., Philadelphia; and 2400 Rossville Blvd., Chattanooga.

Anderson Brass Co. has announced acquisition of certain assets of the Brass Div. of Detroit Brass and Malleable Co. According to plan, these have been used to form the nucleus of a new company, Detroit Valve Co., which will be operated as a wholly owned division of Anderson Brass.

new facilities

A rolling mill to fabricate aluminum alloy sheet in light gages is to be installed by Aluminum Co. of America. The 44-in. mill will be capable of producing close tolerance coiled or flat sheet in finished widths up to 36-in. The project, which is expected to cost more than $4-million, will take about 18 months to complete.

V V V

A modern $5-million factory to house what is expected to be the largest screw and bolt plant will be started shortly for the National Lock Co. in Rockford, Ill. The new plant, which

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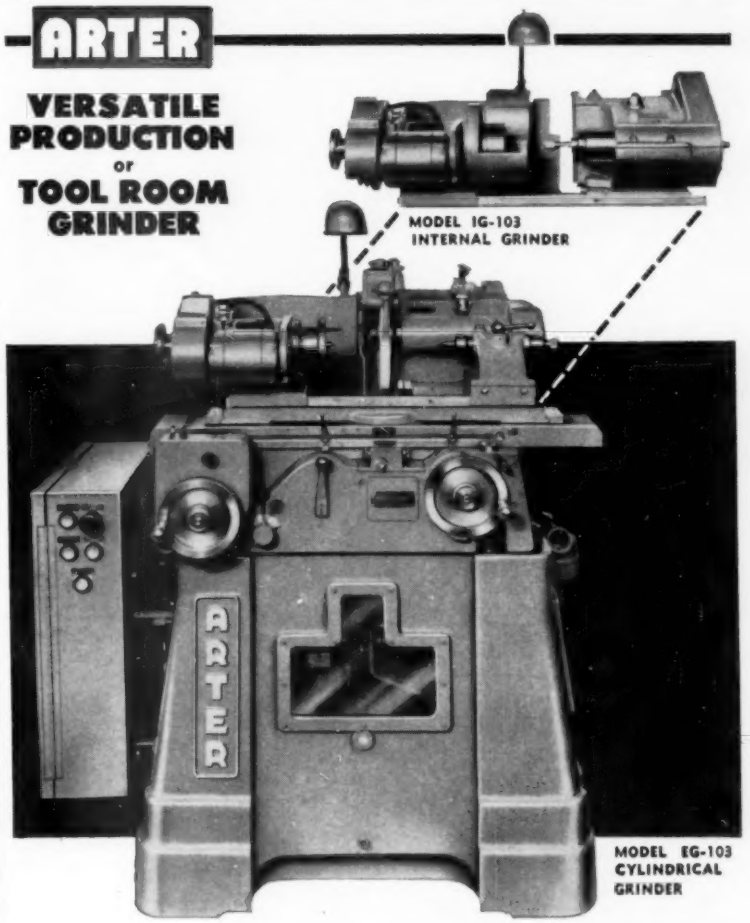

Arter's dual purpose grinder — Internal Grinder or Plain Cylindrical Grinder by simply changing wheelheads. This relatively low-priced grinder, designed for tool room or production work where small-in-capacity machine is needed, can be used as prime equipment or as an auxiliary to larger machines.

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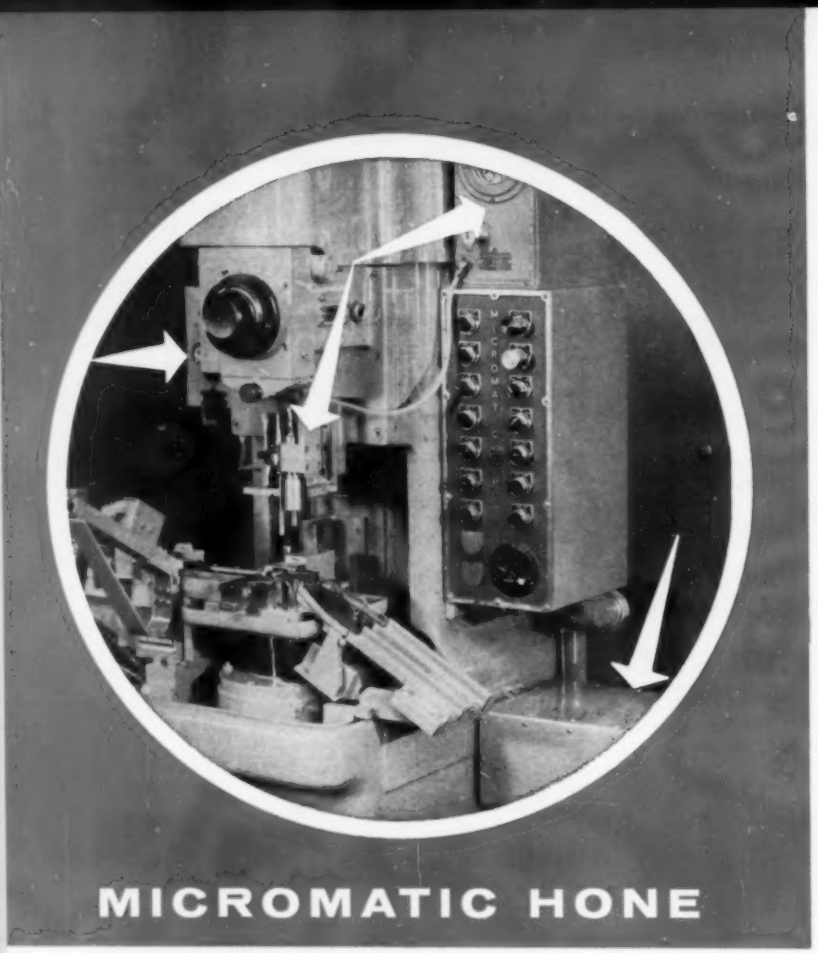

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will contain about 600,000 sq ft, is scheduled for completion by fall of 1957. According to company plan, removal of the screw manufacturing activities from the present plant will make it possible to relocate other departments for better work flow and more economical operation and will release rented factory space as well.

V V V

The new $1-million manufacturing plant for the Heiland division of Minneapolis-Honeywell Regulator Co., was appropriately opened recently with a flash of electronic light. The flash triggered a chain of electronic equipment to swing open the doors of the new plant located on the outskirts of Denver.

V V V

An ultra-modern installation to produce railway bearings is being built at Columbus, Ohio by The Timken Roller Bearing Co. The plant is to be built with the $5-million appropriation announced earlier this year. Completion is expected by January 1, 1957.

V V V

Complete facilities ranging from design through manufacture of printed circuits have been announced by Cleveland Metal Specialties Co. The company also offers a tin-plating process among its services to industry.

move

With the completion of its new plant, Oster Mfg. Co. has moved to E. 289th St., Wickliffe, Ohio, a suburb of Cleveland. The new plant provides single location facilities for production of the company's extended line of equipment.

sales personnel

Appointment of Charles H. Hallett as manager of the Wallingford, Conn., plant has been made public by Joseph T. Ryerson & Son, Inc. He has been a member of Ryerson since 1941, most recently serving as assistant sales manager at Chicago.

V V V

Ekstrom, Carlson & Co. has announced several new personnel appointments. New general sales manager is Ray C. Reinhartsen, formerly vice-president and general manager of Onsrud Machine Works, Inc. Fred J. Heid, who has been general sales manager for the past eight years, was appointed exclusive representative to the aircraft industries in the eastern half of the United States. At the same time, G. R. Gordon, formerly assistant chief

tool engineer in charge of manufacturing research for Convair, was named exclusive representative to the aircraft industry in the western half of the United States. Mr. Gordon is a member of ASTE's North Texas chapter.

V V V

Adamas Carbide Corp. has named Clark B. Frothingham as district sales manager for its northern Illinois territory. For the past 14 years he has worked in various sales and production supervisory capacities in the Chicago area.

V V V

Four sales managers have been appointed by the Abrasive Div. of Norton Co. in a move to consolidate each product line under a single head. Donald L. Price became sales manager of grinding wheels; George A. Park, of abrasives; Harlan T. Pierpont, of refractories; and Fred L. Curtis, of new products.

V V V

E. G. Merk has been promoted to the office of vice-president of sales for Benchmaster Mfg. Co. He has been associated with the company since 1951.

V V V

Crucible Steel Co. of America has named Clayton K. Baer as manager of the Milwaukee, Wis., sales branch. Prior to this appointment he was assistant to the manager of Crucible's Tool Steel Sales Div.

distributors

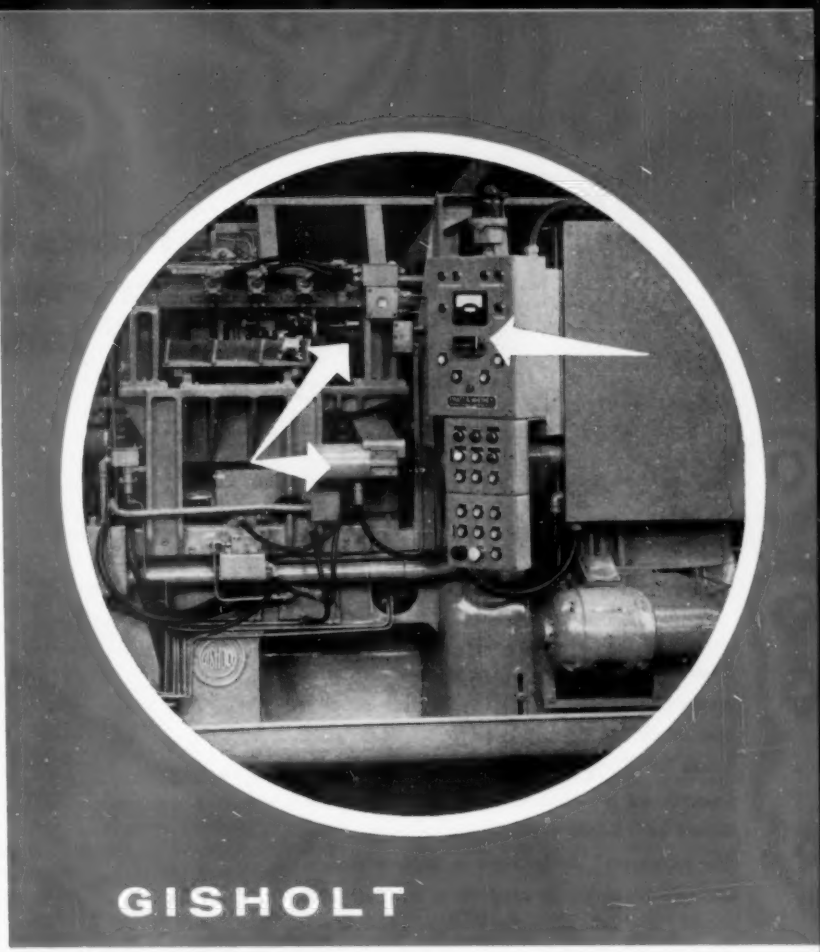
Kling Bros. Engineering Works has expanded its distributor organization to include representatives in more than 30 of the principal cities covering major trade areas of the United States and Canada. The company has published a listing of this network of distributors so that manufacturers may quickly locate the representative nearest them.

V V V

Several new distributors have been announced by Seneca Falls Machine Co. L. W. Hodson Machinery Co., Mariemont Center Bldg., 6914 Miami Rd., Cincinnati, Ohio, will serve the Dayton-Cincinnati area. In the Philadelphia, Maryland and Delaware areas, Seneca Falls will be represented by Production Machinery Distributors, 53 Long Lane, Upper Darby, Pa. Geoffroy-Lane, Inc., 432 E. First Ave., Denver 3, Colo., will be the representative in the Colorado, Utah and New Mexico area.

V V V

New stocking distributor for the tap line of Besley Wells Corp. is Austin Ford Logan, Inc., located in Buffalo, N. Y.



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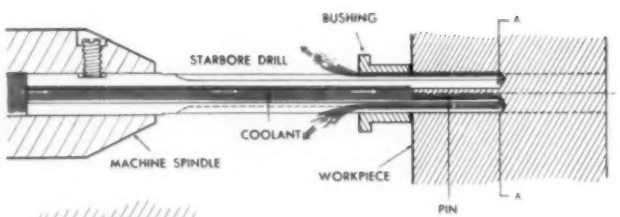

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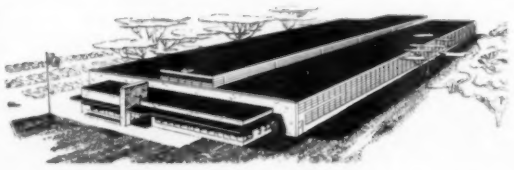


Men at Work

William G. Stewart, formerly executive vice-president of Universal-Cyclops Steel Corp., has been made that company's new president and chief executive officer. He has been associated with the firm in sales and administrative capacities since 1929. Mr. Stewart succeeds **Edward L. Stockdale** who became board chairman and also will serve as consultant.

At the same time, other changes in company offices included **Frank Garratt** and **U. Grant Miller** who retired as vice-presidents but will remain as company directors. **John O. Rinek,** a company officer and director, was named advisory vice-president while also retaining an active part in sales. **W. J. Long,** who was made a vice-president six years ago, was made vice-president-sales and was elected a director. Both Mr. Rinek and Mr. Long are members of ASTE's Pittsburgh chapter. **Walter E. Baker,** vice-president, was appointed to supervise operations.

Paul H. Richardson has been made vice-president in charge of engineering for The Hartford Special Machinery Co. Prior to joining Hartford Special, he was general manager of the Paragon Gear Works, Inc.

New president of Linde Air Products Co., division of Union Carbide and Carbon Corp., is **E. B. Suydam** who has been a vice-president since 1942. He succeeds **T. D. Cartledge** who continues as a vice-president of the corporation.

Following the presidential appointment, **William M. Haile** was named a vice-president of the company. He has been manager of the eastern division since 1952.

Officers elected to serve with the new president of George Gorton Machine Co. include **Charles Gorton,** who is now vice-president in charge of manufacturing; **James Gorton,** vice-president in charge of research and development; **Walter B. Tomlinson,** vice-president and treasurer; **Howard C. Holmdohl,** secretary, and **John Elholm, Jr.,** assistant secretary. Charles Gorton is a member of ASTE's Racine chapter.

Recent announcement by The Colson Corp. revealed appointment of **Richard H. Latimer** to the post of plant superintendent, replacing Arthur Davis who retired. Mr. Latimer formerly was plant superintendent for Eagle Mfg. Corp.

Sharon Steel Corp.'s board of directors appointed **Henry Roemer** to the office of president to succeed **Henry A. Roemer, Jr.,** who resigned as president and director in order to devote his time to other companies in which he has interests. The new president also continues to serve as chairman of the board, chairman of the executive committee and chief executive officer.

George E. Munschauer has become chairman of the board and chief executive officer of Niagara Machine & Tool Works. Grandson of the company's founder, George J. Munschauer, he has been associated with the firm since 1928, serving as treasurer and a director since 1941 and as vice-president and treasurer since 1945.

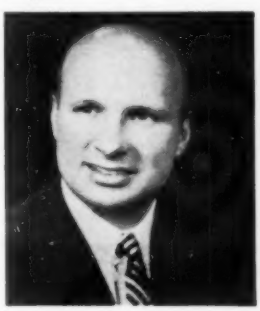
Franklin A. Reed, who was elected vice-president in charge of sales, has been sales manager and a director of the firm since 1945. Mr. Reed is a member of ASTE's Buffalo-Niagara Frontier chapter.

Election of **Fred S. Gombert** as a divisional vice-president has been revealed by Ingersoll Conditioned Air Div. of Borg-Warner Corp. Mr. Gombert has been manager of the division.

Howard J. Findley was elected president of The Cleveland Hobbing Machine Co. to succeed William Staples who retired. He also was elected a vice-president of The Fanner Mfg. Co. and will be its director of engineering and research.

George Gorton III has been elected to the office of president of George Gorton Machine Co. following the recent death of George Gorton II. The new president formerly was the company's vice-president, general manager and export manager.

Frederick E. Munschauer, Jr., formerly vice-president in charge of manufacturing and industrial relations, is new president of Niagara Machine & Tool Works. He is a member of ASTE's Buffalo-Niagara Frontier chapter.



George G. Raymond, Jr., president of Raymond Corp., has been elected president of The Material Handling Institute, Inc. He also has served as president of Association of Lift Truck and Portable Elevator Manufacturers.

Paul H. Richardson was named vice-president in charge of engineering for The Hartford Special Machinery Co. Prior to joining Hartford Special, he was general manager of the Paragon Gear Works, Inc.

Edward Baruch was elected executive vice-president of Heli-Coil Corp. Instrumental in forming Heli-Coil in 1949, he has been vice-president in charge of sales and a director of the firm since that time.

Merrill A. Hayden was appointed general manager of Waterbury Tool, Div. of Vickers Inc. to succeed Warren E. Rouse who retired. Prior to this appointment, Mr. Hayden had been assistant general manager.

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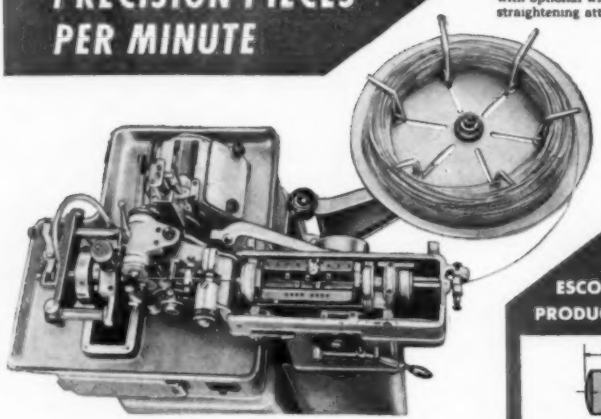

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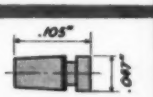
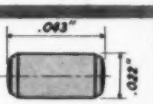
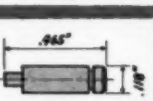


63/min.—nickel-silver



50/min.—nickel-silver



10/min.—mild steel

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Michael L. Kendall has been made engineering and maintenance consultant for The Hartford Special Machinery Co. in the Detroit area, where he is available for engineering, maintenance and trouble shooting work. Mr. Kendall is a member of ASTE's Detroit chapter.

Elected to serve as vice-presidents of The Material Handling Institute, Inc. along with new president George C. Raymond, Jr., were **John W. Stiles** as first vice-president and **R. L. Fairbank,** second vice-president. Mr. Stiles is president of Island Equipment Corp. while Mr. Fairbank is sales manager of Towmotor Corp.

Edgar W. Engle has been made technical director of Vascoloy-Ramet Corp. to be responsible for the company's expanded research, development and application engineering activities in the cemented carbide cast nonferrous alloy field.

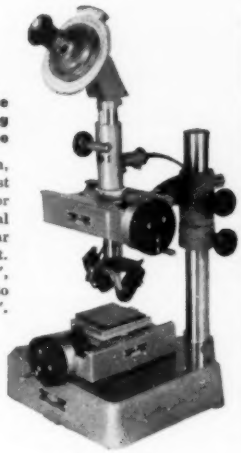
Jessop Steel Co.'s board has elected **Charles E. Rice** to the post of executive vice-president. He has been vice-president in charge of sales for the past five years. Mr. Rice also is president and director of Jessop Steel of Canada, Ltd., and vice-president and a director of Jessop Steel International Corp. Both firms are wholly owned Jessop subsidiaries.

The board of directors of Kearney & Trecker Corp. has confirmed the appointment of **Morris L. Hutchens** as chief engineer of the company, to succeed **Orrin W. Barker** who recently was made vice-president in charge of engineering. Mr. Hutchens has been chief engineer of special machinery since 1952.

F. A. W. Anger has been made director of manufacturing at Axelson Mfg. Co., a division of U. S. Industries, Inc. For the past three years, he has been works manager for Kaiser and Willys Motors, and has also been engaged in special studies here and abroad for the vice-president of manufacturing.

Henry Bryk is the new superintendent of Metal & Thermit Corp.'s Thermit Metal Dept. He formerly was plant manager for Arwood Precision Casting Co.

As part of its expansion program and development of new grades of carbide, Willey's Carbide Tool Co. has announced appointment of **Don M. McPherson** to the post of general manager. He joined the company in 1953 after extensive experience at Ex-Cell-O.



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INDICATE A-2-201-1

abstracts of FOREIGN LITERATURE

By M. Kronenberg
Consulting Engineer

Hannover Machine Tool Show

Although few entirely new machine tools were displayed at the recent machine tool show in West Germany, a few interesting machines are described by F. W. Simonis in the November 11, 1955 issue of *Zeitschrift les Vereins Deutscher Ingenieure*.

One of these is a lathe with two faceplates side by side. The faceplate in the center line of the machine is used conventionally, while the other one, parallel to it, serves to rotate the master in copying jobs. In this way it is possible to produce and copy workpieces that are irregular in shape.

A duplex facing lathe discussed in the article is designed for copying relatively flat workpieces such as disks, brake drums, wheels and gears. They can be machined simultaneously on both faces by means of carriages on either side of the work. These carriages advance automatically into working position but can also be operated by hand and interrupted at any instant. The machine is designed for constant cutting speeds between 60 and 450 sfpm, obtained by stepless regulation of the spindle speeds between 14 and 524 rpm. Feeds cover a range from about 0.003 to 0.040 inch per revolution. They can also be controlled by an infinitely variable feedbox drive.

Another company displayed a lathe where the swing can be changed by moving headstock and tailstock up or down on two inclined surfaces of about 45-degree inclination. The swing can thus be increased by 45 percent, that is from 22 to 32 inches.

A Swiss automatic has a headstock with axial adjustment, which permits taking barstock along. This design is for long workpieces. The spindle bearing can be adjusted without disassembly to compensate for thermal expansion and obtain greater accuracy.

On a vertical boring mill the crossrail is made an integral part of the column. This design has been developed to increase rigidity of the machine. Cutting speeds can be pre-

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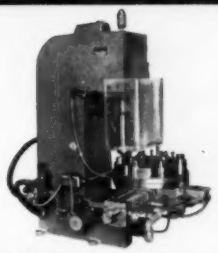

IT'S BEEN DONE—for a "big 3" auto company. Tooling shown increased production on press assembly of steering knuckles from 1200 to 1800 pieces per hour—with added operator safety. **COMPLETE SET-UP**—#1405 Air Index Table, #C-300 5½ Ton Press, controls and fixtures were furnished by Air-Hydraulics, Inc. An electrical circuit synchronizes press and table for fully automatic operation on standard line pressures. Operator places pieces on fixture outside guard • Parts are indexed into position and pressed together • Assembly is removed automatically and chuted into container. Constant pressure throughout ram stroke has eliminated previous trouble caused by variations in stock thickness and other factors.

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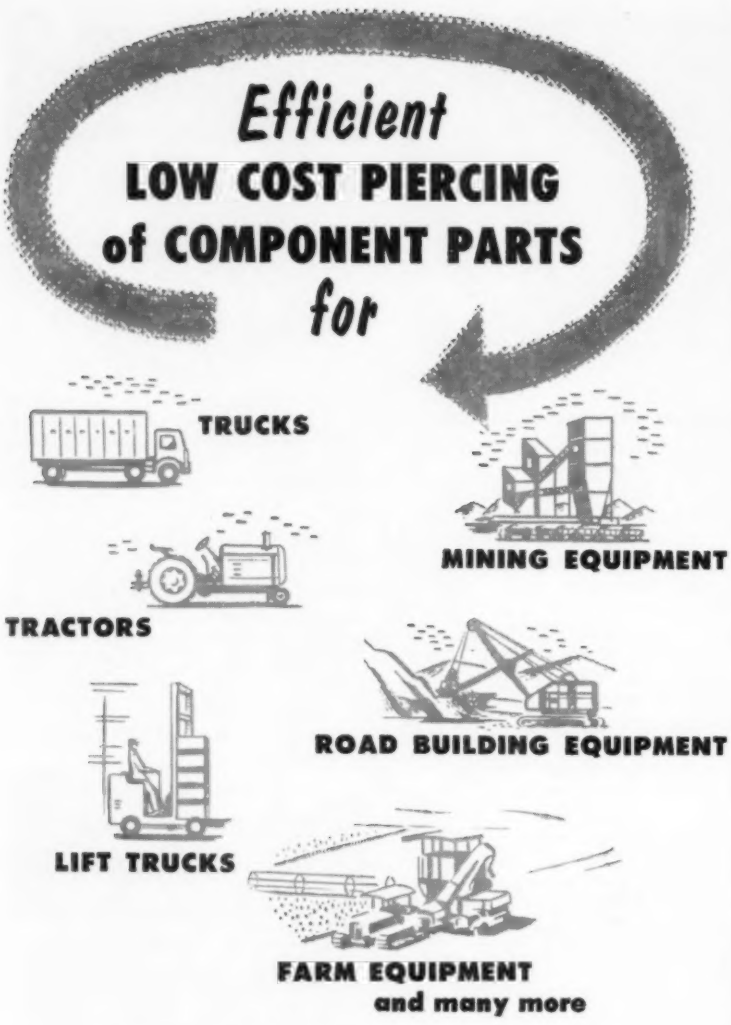

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selected and changed while cutting, although a stepless drive can also be used in order to keep the cutting speed constant.

European radial drills usually have the motor on the drill head as contrasted with American practice, where the motor is placed on the opposite side of the column on the arm. In European practice several rods and gears can be eliminated by direct speed drive, as shown by machines displayed. Motors must, of course, be accurately balanced when placed on top of the drill head, in order to avoid vibration.

Supersonic drilling machines were also on exhibit. Vibrations of 25,000 cycles per second were employed for machining of carbide tools. Any profile can be produced and a surface finish of 0.000040 inch is obtained when boroncarbide is used as a cooling agent. The process is not recommended for soft metals nor for thin-walled workpieces.

Models of transfer lines were exhibited with typical tool control boards. Other outstanding machine tools include a copying milling machine for machining of eight turbine wheel blades simultaneously and a grinding machine with needle bearings for the slides which were made dustproof by a hydraulic seal.

Thread rolling was shown with three carbide rollers and accurate adjustment devices. Clamping toolholders with dovetail guideways were shown and also a method of soldering carbides using a copper alloy which does not clog the grinding wheel.

Brazing Research

Brazing is the stepchild of industrial research according to an article by J. Colbus in number 11, 1955 of the magazine *Konstruktion*. The author who is the director of the Bureau of Standards (Materialprofanstalt) of the Saar District indicates that details of soldering and brazing are usually unknown to engineers and mostly considered as belonging in the field of craftsmanship. In order to remedy this condition a research project was started which included brazing, soldering, braze-welding, hard-soldering, soft-soldering and bronze-welding. Starting with clear definitions for the various types of brazing, the author discusses temperature first.

An upper and lower temperature limit exists and also a working temperature which is used for instructing the operator about the temperature required at the point of fusion.

The metallurgical aspects of the project are then discussed. This includes the diffusion of the metals involved, with a theory of atomic struc-

ture, and includes brazing of carbides and the adhesion or diffusion occurring with these materials. A study was also made of the best flow time for the braze varying between 15 and 60 seconds depending on the solder used.

In another chapter a report is given on tests made to determine the tensile strength at the brazing seams of various types and shapes. It was found that tensile strength increases as the width of the seam decreases where the solder metal is weaker than the two metals joined. Width of seam was found of little effect where the tensile strength of solder and the joined metals were about the same. In brazing carbide tips it was found that shear strength increased with the width of the original gap. As an example, the shear strength was 21,000 psi when a gap of 0.004 inch was used but increased to 35,000 psi when the gap was 0.009 inch.

The theory is advanced that the difference in the coefficients of expansion of steel and carbide tip plays a significant role, although the shear strength did not increase any further when the gap was increased to 0.036 in.

The author continues his report with a chapter on practical data for soldering, including tensile strength and methods. The surface finish of the metals to be joined has been considered and economic findings are likewise included in this study.

Machine Tool Brakes

An article dealing with brakes for machine tool motors is authorized by J. Jopski in the October 11, 1955 issue of *Zeitschrift des Vereines Deutscher Ingenieure*. After discussing various types of electrical and mechanical brakes, the author describes a three-phase motor where the rotor is tapered and can be shifted axially. He believes this the best solution of the problem of stopping machine tools to avoid time losses. In this method a spring holds the rotor and a brake drum, which is attached to the rotor axis, in contact with a brake ring when the motor is not running. Upon starting the motor, the magnetic field pulls the rotor into the stator, while the spring pushes the rotor out of the stator when it is stopped. The brakes can be applied continuously up to 1000 times per hour, although it is possible to start and stop the motor up to 3600 times per hour.

A new factory at Peterhead, in Scotland, is under way for the Cleveland Twist Drill Co. to manufacture high-speed twist drills and other cutting tools. The factory is expected to be in production in about a year.

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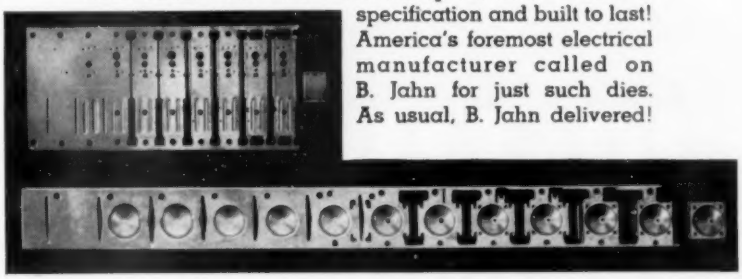

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who's meeting and where

Feb. 1-2. Armour Research Foundation of Illinois Institute of Technology and Chicago Section of American Welding Society jointly sponsoring second annual Midwest Welding Conference. Details are available from from the Institute office, 35 W. 33rd St., Technology Center, Chicago 16, Ill.

Feb. 9-10. The Society of American Military Engineers. Annual technical meeting, Palmer House, Chicago, Ill. Get more information from society office, 808 Mills Bldg., Washington 6, D. C.

Feb. 17-18. National Society of Professional Engineers. Annual spring meeting, Mayflower Hotel, Washington, D. C. Write for particulars to society headquarters, 1121 Fifteenth St. N. W., Washington 5, D. C.

Mar. 8-9. The Society of the Plastics Industry Canada, Inc. 14th annual Canadian conference, Sheraton-Brock Hotel, Niagara Falls, Ontario, Canada. More information may be had from The Society of the Plastics Industry, Inc., 67 W. 44th St., New York 36, N. Y.

Mar. 14-16. Pressed Metal Institute. Annual spring technical meeting, Hotel Carter, Cleveland, Ohio. For more information, contact H. A. Daschner, managing director of the institute, 3673 Lee Rd., Cleveland 20, Ohio.

Mar. 14-16. American Society of Mechanical Engineers. Aviation Division conference, Beverly-Hilton Hotel, Los Angeles, Calif. Direct inquiries to Southern California Section of ASME, c/o Lynn-Western, Inc., 6901 Melrose Ave., Los Angeles 38, Calif.

Mar. 19-20. Steel Founders' Society of America. Annual meeting, Drake Hotel, Chicago, Ill. Complete facts may be obtained from society offices, 606 Terminal Tower, Cleveland 13, Ohio.

Mar. 19-21. Society of Automotive Engineers, Inc. National production meeting and forum, Hotel Statler, Cleveland, Ohio. More information may be had by writing society offices, 29 W. 39th St., New York 18, N. Y.

Mar. 19-23. American Society of Tool Engineers. Industrial Exposition, International Amphitheatre, to be held coincidentally with the annual meeting, Conrad Hilton Hotel, Chicago, Ill. Complete details are available from Society offices, 10700 Puritan Ave., Detroit 38 Mich.

Apr. 10-12. Metal Powder Association. 12th annual meeting and 1956 Metal Powder Show, Hotel Cleveland, Cleveland, Ohio. Additional information is available from association office, 420 Lexington Ave., New York, N. Y.

Apr. 18-20. Armour Research Foundation of Illinois Institute of Technology. National industrial research conference, to be held as part of Foundation's 20th anniversary. Further details may be obtained from Institute, 35 W 33rd St., Technology Center, Chicago 16, Ill.

Apr. 21. State University of Iowa and American Society of Tool Engineers in conjunction with ASME, AIIE, IEAI and other Iowa and Western Illinois organizations are sponsoring the second annual Engineers-Manage-

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ment Conference. More details may be gained from the university's School of Engineering, Iowa City, Iowa.

May 3-9. AMERICAN FOUNDRYMEN'S SOCIETY. 60th annual foundry congress and exhibit. Convention Hall, Atlantic City, N. J. For further facts, contact society headquarters, Golf & Wolf Rds., Des Plaines, Ill.

May 7-11. AMERICAN WELDING SOCIETY. National spring meeting, and fourth Welding & Allied Industry Exposition, Buffalo, N. Y. Definite data is available from society headquarters, 33 W. 39th St., New York 18, N. Y.

May 14-17. DESIGN ENGINEERING SHOW. First of annual shows to be devoted to original equipment which goes into manufacture of finished products. Convention Hall, Philadelphia, Pa. Contact exposition managers, Clapp & Poliak, Inc., 341 Madison Ave., New York, N. Y.

June 3-8. SOCIETY OF AUTOMOTIVE ENGINEERS, INC. Summer meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. More facts are available from society office, 29 W. 39th St., New York 18, N. Y.

June 5-7. THE MATERIAL HANDLING INSTITUTE, INC. Technical sessions and Exposition, Cleveland Auditorium, Cleveland, Ohio. Complete facts may be obtained from institute office, Room 759, One Gateway Center, Pittsburgh 22, Pa.

June 17-21. AMERICAN ELECTROPLATERS SOCIETY. 43rd annual convention, Hotel Statler, Washington, D. C. Full information may be had from society office, 445 Broad St., Newark 2, N. J.

June 17-22. AMERICAN SOCIETY FOR TESTING MATERIALS. 59th annual meeting and 12th apparatus exhibit, Chalfonte-Haddon Hall, Atlantic City, N. J. Write for particulars to society headquarters, 1916 Race St., Philadelphia 3, Pa.

June 11-15. THE SOCIETY OF THE PLASTICS INDUSTRY, INC. 7th National Plastics Exposition, New Coliseum, New York, N. Y. Request further facts from society headquarters, 67 W. 44th St., New York 36, N. Y.

June 25-29. THE AMERICAN SOCIETY FOR ENGINEERING EDUCATION. Annual meeting, Iowa State College, Ames, Iowa. Details may be obtained from office of the society secretary, W. Leighton Collins, University of Illinois, Urbana, Ill.

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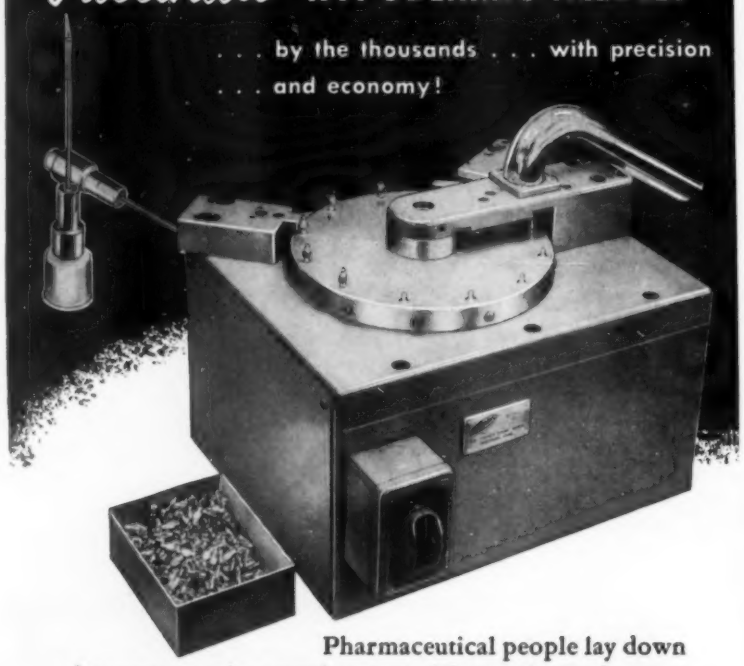

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good reading

DIESEL ENGINE PRINCIPLES & PRACTICE —*Edited by C. C. Pounder. Published by Philosophical Library, Inc., 15 E. 40th St., New York 16, N. Y. Price $17.50. 848 pages.*

Arranged in twenty-six sections from theory to application, the material presented is useful to engineers and students in any field where diesel engines might apply. A comprehensive reference book starting with the thermodynamic principles and continuing with fuels, blowers, exchangers, starting apparatus and following with torsional vibration, engine balancing and materials. An up-to-date practical survey of diesel engineering practice.

HANDBOOK OF ENGINEERING MATERIALS —*by John Seastone and Douglas F. Miner. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y. Price $17.50. 1382 pages.*

Engineers are frequently confronted with material problems involving areas of knowledge not familiar to them. For this purpose, the Handbook was designed to meet a need, for a single source of authentic and useful information on the usual materials of manufacturing and construction. Compiled at a professional level understandable to engineering personnel, it covers the principal factors in selecting a material; namely, (1) properties, physical and chemical; (2) adaptability to fabricating methods; (3) availability and (4) cost.

RADIO INTERFERENCE SUPPRESSION TECHNIQUES. *Obtained from OTS, U. S. Department of Commerce, Washington 25, D. C. Manual PB 111611. Price $6.75. 270 pages.*

This manual contains information on approved suppression components and systems and their application. It explains the procedures recommended for obtaining approvals, requesting tests by the Signal Corps, and in getting assistance in solving special problems.

Some of the individual sources of radio interference dealt with are rotating machinery, ignition systems, switches and contractors, electronic devices, fluorescent lamps and instruments. The book also discusses the suppression of complete equipment such as vehicles, boats, airplanes, locomotives and teletypewriters.

The manual concludes with a brief outline of suppression principles.

BASIC MATHEMATICS FOR SCIENCE AND ENGINEERING — *by Paul G. Andres, Hugh J. Miser, and Haim Reingold. Published by John Wiley & Sons, Inc., 440 4th Ave., New York 16, N. Y. Price $6.75. 846 pages.*

The book assembles those topics from algebra, trigonometry and analytic geometry that are essential to the study of calculus, engineering theory and practice, and the various sciences. Among the outstanding features are early explanations of the slide rule and trigonometric functions. The mathematical principles are illustrated with applications chosen from a wide variety of scientific and engineering fields with terminology and notations drawn from current technical usage.

PLASTICS FOR CORROSION-RESISTANT APPLICATIONS—*by Raymond B. Seymour and Robert H. Steiner. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Price $7.50. 423 pages.*

Compiled from the author's extensive experience in the plastic field, this book supplies engineers with the background information necessary in selecting the proper plastic for construction in corrosive atmospheres.

Relationships between the chemical and physical properties and the molecular structure of plastic materials are pointed out in the opening section. This information is followed by the use of plastics as protective coatings, organic linings, chemical-resistant mortar cements, casting resins, plastic foams, impregnants, industrial adhesives, and reinforced materials. Wherever possible, plastics available for a specific application are compared in tabular form for quick, easy selection of the most suitable material.

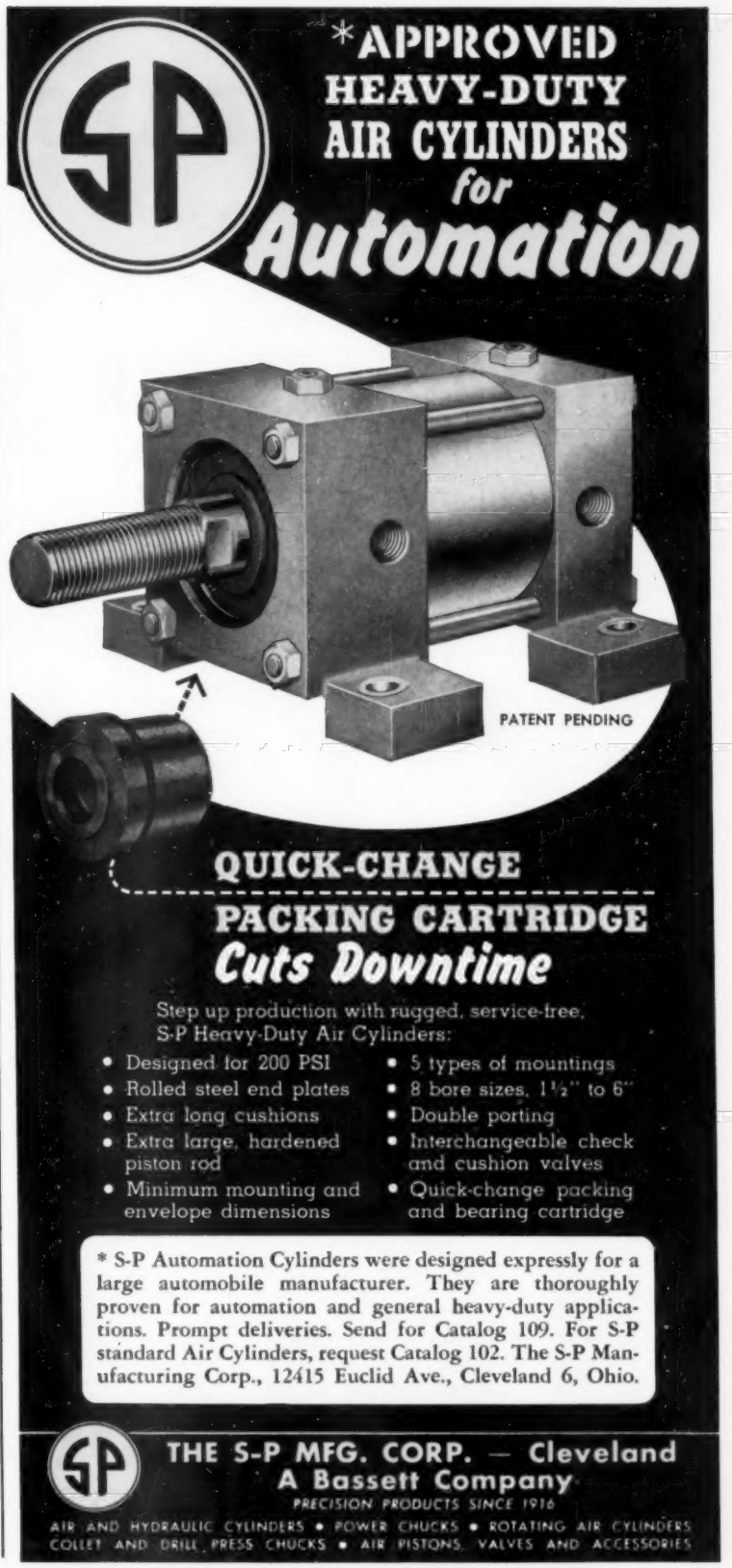
MOTION AND TIME STUDY—*by Gerald Nadler. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price $7.50. 612 pages.*

The book attempts to set forth a certain operating procedure which has been found to be highly successful in solving motion and time-study problems.

Concepts of motion and time study are not restricted to the performance of the human being only; the broader aspects of product, and the equipment with which the operator works, are included.

New and old techniques, and adaptations of old techniques are described in detail and their effect on concept and practice is fully discussed.

Human beings, individually and as members of labor or management, play a major role throughout the book, in the presentation of approach, concept and techniques.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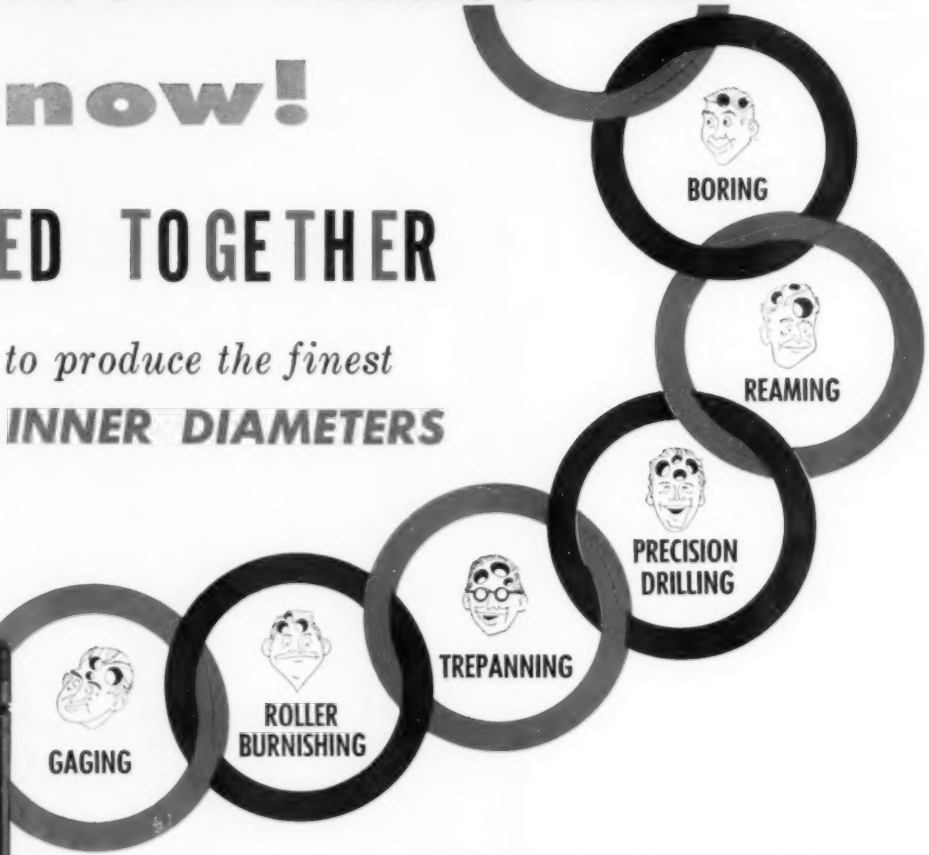

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Shell Molding Advances Foundry Automation

technical digests

By James Sutherland
Foundry Equipment Div.
Link-Belt Co.
Chicago, Ill.

MANY FOUNDRIES have become highly mechanized incorporating charging equipment, as well as sand, mold and casting-handling equipment. Much of the labor of charging cupolas, molding, pouring and shakeout has been minimized through mechanization. Some operations, such as sand preparation, are handled by completely automatic units, *Fig.* 1. Reduction of hard physical work has increased production per man-hour 50 to 100 percent and made thee foundry a more desirable place to work.

The shell-molding process by nature lends itself to a greater degree of automation. The shell mold can be made by completely automatic molding machines, the production determined by the machine cycle and possibility of errors in judgment by molders eliminated. An equivalent shell-molding installation requires only about 2 tons per hour of sand-resin mix and the molds produced weigh less than one-tenth of the weight of an equivalent green sand mold. This reduction in mold weight, as well as material requirements, greatly simplifies design of automatic equipment.

A highly mechanized shell-molding installation, consisting of completely automatic shell-molding machine, shell-closing machine, storage conveyor and pouring conveyor is shown in *Fig.* 2. For this foundry, a ¼ in. shell is required since pouring is horizontal without backing material. Based on a 12 sec. investment time required to form this thickness of shell, the four-station automatic shell-molding machine produces at the rate of 200 shell molds per hour. The completed shell, *Fig.* 3, is automatically ejected from the pattern at the ejector station by means of pins incorporated in the pattern. The drag half is placed on the core-setting belt by the machine operator who completes the closing operation on the shell-closing machine. The core-setting belt conveyor is necessary since some molds require as many as 24 cores. After cores are set, the drag half is placed on the shell-closing machine, resin applied around the mold cavity and the cope half positioned by the shell-molding machine operator. The shell-closing machine consists of four pressure-pin units mounted on a turntable. It is synchronized with the shell-molding machine cycle.

Closed shell molds are transferred to storage conveyor and then to pouring conveyor. Molds are then conveyed to the pouring area and after sufficient cooling time, are automatically dumped onto a sorting oscillating conveyor.

Shell molding brings automation one step closer to the foundry industry. Production is dependent upon the shell-molding machine cycle. Handling of sand and resin to storage as well as the proper mixing and delivery of the sand-resin mix to the shell-molding machine can be completely automatic, *Fig.* 1. It is possible to eliminate the machine operator and labor involved in placing and removing shell molds at the closing machine, by means of mechanical equipment. Inspectors, however, check the shells at the machine and the molds after closing, assuring satisfactory operation of this system.

Mold production per man-hour in the foundry has practically doubled in comparison to mechanized green-sand installation. In addition, castings pro-

Fig. 1. Automatic sand plant with storage bin, feeders and mixers.

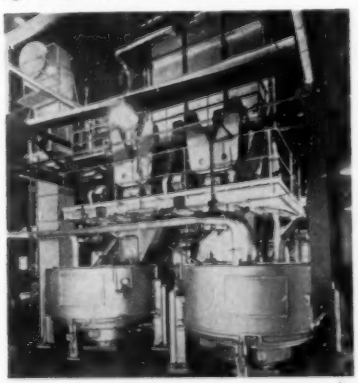
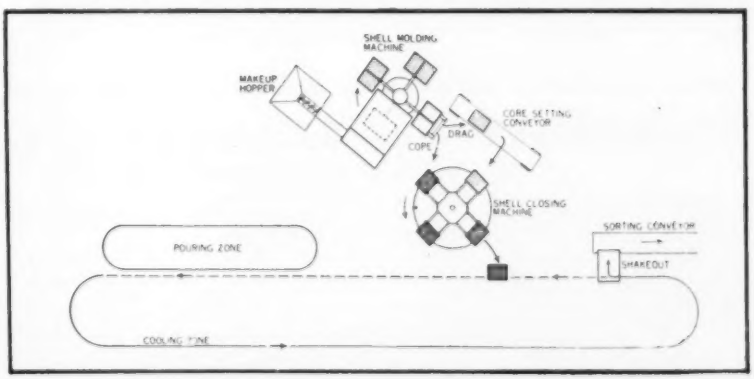


Fig. 2. General arrangement of mechanized shell-molding installation in Indianapolis plant. Mechanization is utilized wherever economically feasible.



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duced by shell molding have superior finish and greater dimensional accuracy when compared to green-sand moldings. Also, an increased yield of castings per ton of metal poured can be realized.

The trend is definitely under way for mechanization of foundries of all types.

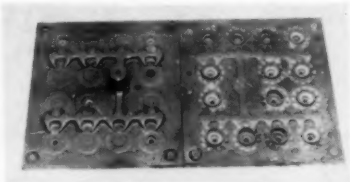

Fig. 3. Typical shell-mold pattern incorporates ejector pins to strip off the mold.

Several factors have contributed towards this advance. Results definitely prove that a properly designed mechanized foundry can produce more castings in a given time than conventional foundries. This applies to both green-sand molding and shell molding, as well. Shell molding represents the means of approaching a step closer to automation of foundries and will greatly advance the degree of mechanization realized at this time. To produce a better product at a lower cost is still the primary object of the foundry industry.

From a paper given at the ASME Diamond Jubilee Annual Meeting, Chicago, Ill., Nov., 1955.

▼ ▼ ▼

Need for Basic Research

By Glenn T. Seaborg
University of California
Berkeley, Calif.

The role of basic research in training of scientists and engineers is a very important one. The university graduate school is the most effective device for cultivation of intellectual powers of a potential scientific investigator. The paramount business of the university graduate school is to make learning possible. In principle, there are no boundaries on questions asked and answers to be sought. An atmosphere of this nature is ideally suited for the inspiration of the superior human intellect and for challenging it to its greatest exertion.

The more a university or any other agency engaged in basic research can stick to the goal of unrestricted human thought, the less likely the great intellects are to be deterred from direct

contact with the great unanswered questions of science. The university, by its very nature and purpose, is and will remain the natural center for basic research.

The total research and development expenditure, by government, industry, universities and nonprofit institutions, is presently at a rate of about 3 billion dollars a year. Even a generously broad definition indicates that no more than 5 percent of this total annual budget is used for the support of basic research. This proportion and amount of money is much too small. An expansion by something like a factor of two is needed. Efficient use of money for basic research at such an increased level is easily possible in spite of the shortage of scientists. Results would not go up by a factor of two but the increase would be so large that this would be the greatest bargain that the American people ever received for their money.

Correction of the present inadequate ratio of basic to applied work would soon lead to such a broad improvement in technological advance that the return on the over-all budget for research and development, on any objective basis for evaluation would be increased way out of proportion to the small relative additional cost. The problem of properly balanced research effort is paramount today not only because of the importance of defense research, upon which existence depends, but also because the whole national economy is rapidly becoming tied closely to continued technological advance.

Excerpts from an address given at the meeting on atomic energy sponsored by Atomic Industrial Forum, Inc. and Stanford Research Institute, April, 1955, San Francisco, Calif.

▼ ▼ ▼

Reducing Thermal Damage in Grinding

By R. S. Hahn

Consulting Engineer
Heald Machine Co.
Worcester, Mass.

For many years grinding department foremen have been confronted with grinding checks and burn on ground parts. In recent years, engineers have become concerned with residual stresses introduced in ground parts. There is good evidence that fatigue life and surface stress conditions are related.

First, it is important to understand how grinding variables such as work speed, feed and wheel characteristics influence the workpiece. This paper is concerned directly with the effect of these variables on the instantaneous surface temperatures produced, and thereby concerned indirectly with the actual damage and stress resulting from these temperatures. Such observations as the fact that hard or glazed wheels are more likely to burn or damage the workpiece can be explained in accordance with physical theory. The tendency of fine-grit wheels to burn or the difficulty with the form grinding of deep grooves also becomes apparent. An example is the propensity towards checking at the edges of a ball bearing raceway. The cool cutting action of open structures such as No. 12 structure wheels can also be explained.

Checking, such as a cemented carbide cutting tool or the edges of a ball bearing raceway completely disappeared when the work speed was increased sufficiently. By work speed is meant the speed at which the workpiece is passed under the grinding wheel. In the ball bearing groove operation, complete freedom from checking was obtained at a work speed of 200 fpm. Numerous tests were undertaken to

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investigate the effect of work speed in grinding tools. Carbide tools ground at 600 fpm produced 8.3 parts per tool while tools ground at 20 fpm produced 3.1 parts per tool. Thus it can be seen that high work speeds are effective in reducing checking and cracking of heat-sensitive materials, and also may influence the life of the tool or part.

Contrary to past theory, there is considerable evidence which indicates that in the grinding process it may be more realistic to consider frictional rubbing forces on the clearance surface and neglect cutting forces on the rake surface. With this rubbing grain hypothesis, there are three distinct regions of interest on a grit. This is illustrated in the *Fig.* 1 with a sizable area *OC* in rubbing contact with the workpiece. As the grit becomes dull or worn (a glazed wheel) the length *OC* probably greatly increases to *OC'*. The shear plane is illustrated at *OB* and the grit-clip interface at *OA*. These three areas, *OA*, *OB* and *OC* may be thought of as heat sources. Thus, the grinding process appears, from the point of view of the workpiece, to be a tremendous barrage of small intense heat sources moving very rapidly over a short distance, the interference region *DE*, which itself is moving much more slowly along the work surface.

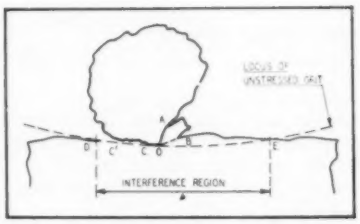

Fig. 1. Sketch of a grit engaged with workpiece: interference region, *DE*; clearance heat source on grit, *OC*; shear-plane heat source, *OB*; grit-chip interface heat source, *OA*.

If the wheel turns at a very high speed and is composed of fine grits closely spaced and the work speed is slow, the wheel source can, to a good approximation, be represented as a continuous band source moving over the surface of the work. This continuous source can be dispersed into discrete grit sources by greatly increasing the work speed.

In contrast to grit-source strength, wheel-source strength is essentially independent of the velocity of the work source, the work speed. In order to see directly effective work speed on surface temperature due to wheel source, data for a moving-band source is platted as in *Fig.* 2. Relative temperature at the trailing edge of the source is plotted against the velocity ratio. V is the work surface speed and V_0 is some arbitrary reference speed. Θ_0 is the temperature at the trailing edge corresponding to the speed V_0. The pronounced drop in temperature at high work speeds is evident. Actually, there is reason to believe that the temperatures fall even faster than shown in the chart.

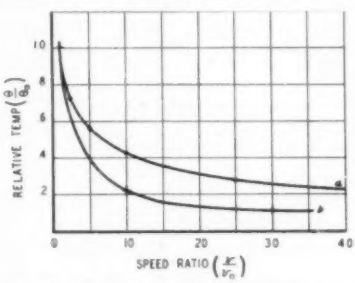

Fig. 2. Rapid fall in surface temperature occurs as work speed increases. Curve *a* is for a constant source length; curve *b* for a source length diminishing with work speed.

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In view of the fact that heat checking in the ball bearing raceway and in carbide tools was completely eliminated by grinding at high work speed and since the theory of heat conduction indicates lower temperatures at high work speeds, it seems safe to conclude that lower temperatures and probably lower residual stress occur under these conditions. In shops where heat-sensitive materials are surface ground and where trouble is occurring due to heat checks or perhaps even early fatigue, it would seem advisable to find some way of increasing the work speed.

From paper 55-SA-60 presented at the June 1955 meeting of ASME, Boston, Mass.

▼ ▼ ▼

Measuring Die Wear Radioactively

By B. J. Jaoul

Dir. of Physical Sciences
Ecole National Superieure
des Mines de Paris
Paris, France

Radioactivation of surfaces has been successfully used in the evaluation of wear produced by friction between rubbing surfaces during short periods of service. The method is applicable to studying on tools, gears, rams and even automobile tires. Particularly, it was used in studying wear of die pieces during hot extrusion of steels. This nondestructive method enables study of wear under severe service conditions where temperature of steel billets may be as high as 2400 F and pressure on the die is about 140,000 lb per square inch.

The technique permits precise determination of the location of wear. Weak points and the concentrations of frictional forces can be determined when the amount of wear is extremely small. It is possible to observe and weigh particles of the abraded die with an accuracy of about one one-millionth of a gram (about 2.2 billionths of a pound). Thus, it is possible to evaluate the influence of temperature, ingot surface, rate of extrusion, die surface and lubricant, and other variable factors on wear. The method reveals the mechanism of die wear and the best shape for minimizing it as well as for increasing die life.

Radioactivation was accomplished by exposing the die, which was made of 10 percent tungsten tool steel, for about two days to the neutron stream of an atomic pile. As a result the tungsten became radioactive to the exent of about 1.5 mc per gram. Readings had to be determined quickly because the degree of accuracy decreases by half each day. Radioactive particles lost by the die were found on the extruded bars.

From a paper 55-SA-24 given at the production engineering division, ASME semiannual meeting, Boston, June 1955.

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Small Volume Production of Metal Powder Parts

By B. I. Horton

Methods Engineer
Pitney-Bowes, Inc.
Stamford, Conn.

When it was decided to use metal powder parts to replace conventional machine parts, comments were that production quantities were too low to justify high tool cost inherent in this type of production. It was said that because of low quantities, it would be necessary to pay premium prices for such parts.

Quotations for parts and tools from custom fabricators were obtained. Comparisons with existing manufacturing cost showed that though production was 10,000 per year or less, considerable savings could be realized and tool costs could be amortized in short times —usually less than two years.

After purchasing several metal powder parts for approximately two years, and gathering considerable information about the process, it was felt additional savings and closer control could be secured by establishing production in the plant.

Results have borne out these beliefs. In the early part of 1953, the company was making approximately 35 different structural parts and approximately 90 different self-lubricating bearings. Savings of approximately 15 percent were shown on bearings, compared against purchased parts, and between 60 and 70 percent on structural parts. Typical parts produced in this manner consist of small meter drive gears, meter gibs and cams. In one instance, for a knife cam, savings realized against conventional manufacturing methods were about 90 percent. A tool cost of approximately $750 was amortized in less than one year. This part is produced in quantities of approximately 5,000 pieces. Some of the most noticeable cost reductions, however, were realized from produc-

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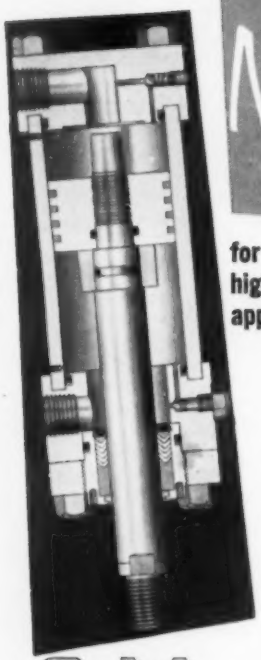

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technical digests

tion of self-lubricating bearings. While low-cost items, an average savings of more than 10 percent was realized after the first year's production. Reasons for success in low-volume production of metal powder parts are several. First is product design. Parts should be properly designed for the process; such parts cause many less variables than those made as substitution for another process.

Another contributing factor is tool design and workability of tooling. Standardization of parts such as self-lubricating bearings, is also important. Through this program of standardization, it was possible to reduce the number of different bearings required from 140 to 93.

Standardization of inside and outside diameters made it possible to produce 68 plain self-lubricating bearings from only twelve sets of tools with additional punches and core rods.

Finally, a major factor is process control, especially in a low-production in-plant facility. Strict process controls in the hands of a limited number of people will tend to eliminate variables and rework which in low-volume production is very costly.

From a paper given at the Annual Meeting of the Metal Powder Assoc., Philadelphia, Pa., May, 1955.

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The Public's Stake in Automation

By Ralph J. Cordiner
President
General Electric Co.
Schenectady, N. Y.

Automation will enable American industry to boost productivity, create new employment, reduce the cost of goods, and increase the real wealth and purchasing power of all Americans.

Progress toward automation will be a step-by-step process that will have a stimulating and stabilizing effect on the national economy and employment.

This company holds six fundamentals on automation and technological change.

1. Technological progress is necessary to maintain national security.
2. It is necessary, in order to continue to raise the American standard of living even at the same rate as the last decade.
3. Technological progress is necessary for individual companies to serve their customers better and prosper in the competitive economic system.
4. Progress toward greater mechanization and automation is in the best interests of all groups that business serves.
5. Technological change is a gradual, evolutionary process.
6. Benefits of mechanization and automation are so profound and urgently needed that they should be encouraged.

Fear that automation will move too swiftly for orderly adjustment overlooks powerful factors which govern the pace of technological advance. There is the difficulty of actually thinking through and designing workable automation developments. Financial risks involved must be evaluated and the business man must weigh carefully each investment in automation. Management must work out some way to assure wider, steadier markets which will justify the investment in new machinery and methods.

In most discussions of automation and the shift in employment any substantial technological changes might cause, the factor of normal employee turnover has not been adequately appreciated. At General Electric any substantial technological changes are planned in such a way that normal attrition of the work force, people who quit, retire or die, will absorb the shift in employment. In the past 12 months, GE has hired about forty thousand new employees to replace those who quit, retired, died, or whose employment terminated for reasons other than lack of work. In the same period, at least thirty-three thousand employees changed jobs within the company because of promotions, technological changes and the normal internal shifts of work force due to lack of work in one area. This is how GE takes care of short-term adjustments which have caused so much concern.

Several factors in technological progress create new employment. More productive machines reduce costs and prices, increasing volume of business and creating a need for more workers. Resulting service industries provide new employment. Industries supplying

automation and technological advance, also create new employment opportunities. This is employment involved in designing, selling, building and installing new machinery and controls, along with new buildings required. In addition, employment is required to maintain and service equipment after it is installed.

Entire new industries, employing thousands, are created by new automation techniques. As examples, there are atomic energy industry, a transistor and semiconductor industry, and an industry for the production of supermetals such as titanium and zirconium, and industries based on new knowledge arising from use of electronic computers. It may be that the computer-derived technologies will be a major source of new employment in the 1960's and 1970's, and they will cause a perpetual shortage of manpower to take advantage of opportunities.

From a presentation before the Joint Congressional Sub-Committee on Economic Stabilization, Oct. 26, 1955.

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Hydraulic Tracing in Small Lot Machining

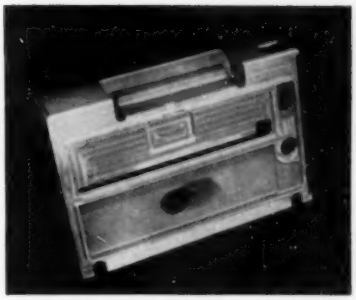
By Thomas Gibson
Consolidated Engineering Corp. Pasadena, Calif.

Hydraulic tracing methods in manufacture of quantities from 25 to 100 pieces has resulted in substantial cost reduction in fixtures, inspection and scrap. It makes use of semiskilled labor feasible and results in an average reduction of actual running time of approximately four to one. In addition, jobs are handled that would be difficult by any other method.

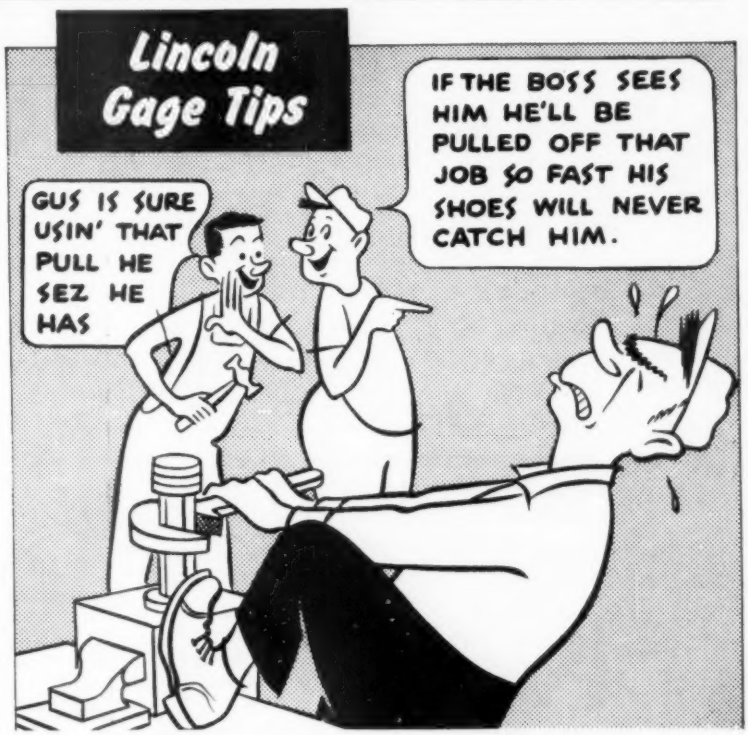
Consolidated Engineering designs and manufactures analytical and control instruments and data processing equipment. Parts produced by tracing methods often involve complicated shapes such as the instrument case panel shown in the accompanying illustration.

Templates are made of aluminum and magnesium and due to low tracing pressures, have shown no measurable wear after considerable use. Every effort is made to complete as many operations as possible in one setup though there may be six different cutting levels and twelve to fourteen different areas to be machined, including holes, slots, contours and other surfaces that can be cut with a vertical machine.

Many templates are stacked three and four high on slip dowel pins to allow machining where overlapping operations occur. A number of vacuum-held fixtures are being used with considerable success. Carbide cutters are employed where size and shape permits. Climb cutting is used about 90 percent of the time. P&W profilers are commonly used in such operations with quick-change chucks, mist cooling and a turret stop with a built-in dial indicator for vertical adjustment of the spindle. Commonly, the tracing template and work holding fixture are attached to a common plate, which has



Instrument case panel typifies irregular contours reproduced by hydraulic tracing equipment.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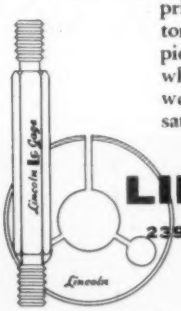

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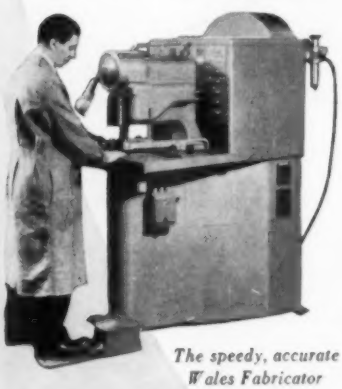

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two locating points for giving correct relative position on stylus and cutting head for quick setup.

One auxiliary advantage of tracing is gain in operator confidence which reduces checking time after first-piece inspection. Also, inspectors have found work produced by tracing is more uniform and if more than one operation is being performed per setup, a reduction can be made in inspection after checking the first operation for size and location.

Reproducibility of such equipment is to 0.002 inch when desired. However, regularly work is 0.003 to 0.005. It should be recognized that a tracer is far from a cure for poor shop practice and a sloppy machine with worn ways and poor spindles. It has been the experience, however, that tracing has proved a good sound method for small lot production.

From a paper given at the Contour Machine Conference sponsored by True-Trace Corp., at El Monte, Calif., Oct., 1955.

▼ ▼ ▼

Industry Needs and Engineering Education

By Charles M. Cooper

Engineering Research Laboratory
E. I. du Pont de Nemours & Co., Inc.
Wilmington, Del.

Education, broadly, has to do with preparation for living. As the environment changes, there should be corresponding changes in the preparation. While teachers must implement needed changes in formal education, people in industry must play a part in defining the goals of formal education. This is an outline of industry's needs for trained men as seen through the eyes of one engaged in industrial research.

The starting point is the check list used in connection with routine appraisals of the technical staff. The items include:

- Knowledge
- Creativeness
- Analytical Ability
- Initiative and Resourcefulness
- Quantity of Production
- Quality of Work
- Ability to Speak Clearly
- Ability to Write Clearly
- Judgment and Common Sense
- Cooperation
- Open-Mindedness
- Reliability
- Leadership

Each item calls attention to some facet or personal aspect or character-

istic. Each of these attributes is important to industry because it measures part of the contribution the individual is making to his job. Each is important to the individual because it plays its part in determining his rate of progress and pay.

The amazing thing is that only three items on this list are directly affected by curricular decisions — knowledge, ability to speak clearly and ability to write clearly. The latter two frequently receive little attention. Curricula are planned to give the student access to knowledge. But unless it is employed effectively, it is useless. Twelve of the thirteen items are concerned with the effective employment of knowledge. It is startling to realize that the bulk of attributes sought in this organization are picked up almost incidentally.

Use of Knowledge

One can conclude that industry needs people who will effectively employ the knowledge they possess and who will recognize and obtain specific knowledge required but not originally possessed.

Do schools recognize the importance of working habits as tools in effective application of knowledge and plan situations that will give students practice in acquiring them? Do they recognize and strive for uniformly high standards of student performance in order to assist students in acquiring good working habits? Do they keep students aware of the importance industry, and life, attaches to effective performance?

Should it not be possible to use the quantitative thinking approach in connection with classroom work and thus give all students who have the creative urge a tool to stimulate their curiosities? Should not facility with mental mathematics be a requirement in any engineering curriculum?

From a talk given at the A.I.Ch.E. Meeting, May, 1955, Houston, Texas.

▼ ▼ ▼

Evaluation of Plastic Tooling

By Russell M. Houghton
President
Houghton Laboratories, Inc.
Olean, N. Y.

Plastic tooling materials are now used for stretch dies, low production, double-action draw dies, Keller patterns, foundry patterns, checking fixtures, welding fixtures, master models,

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Another NEW "Light-Heavyweight"! — cuts bars, rods, tubing ... and production time!

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Walker-Turner "Light-Heavyweight" Abrasive Cut-Off Machine: Capacity: 1-1/2" round bar; 3" tubing. Abrasive wheel, 12" dia. x 3/32", on 1" spindle. Speed, 3720 rpm, 11,710 fpm. Heavy guard provides 216° peripheral protection; easily removed for wheel change. 3 hp. 220/440 v. 3-phase motor — fan-cooled, totally enclosed, ball-bearing, overload capacity up to 7 hp.

Available mounted at 45°

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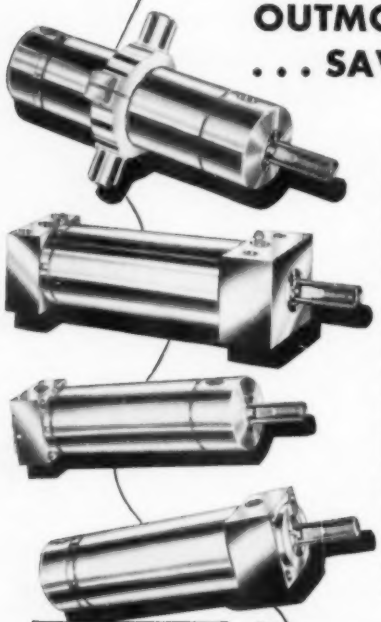

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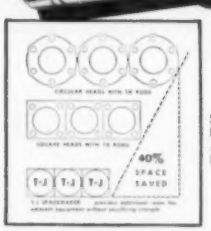

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spinning chucks, jig bases and hydro press dies. The materials are also used in the production of dies for vacuum plastic sheet, acrylic form dies and dies for low pressure molding of plastic parts.

Plastic dies have been used primarily for limited production. The aircraft industry, working principally with light metals, has used plastic dies for some time. Stretch press dies and drop hammer dies are produced on a standard basis at Lockheed, Convair, Republic and others.

Advantages of Plastic Dies

Plastics offer several technical and economic advantages for certain types of dies. These include simplicity in manufacture. Lower tool room equipment investment, use of unskilled and semiskilled labor and elimination of many grinding and polishing operations give lower manufacturing costs.

Surface contours of a plastic die can be modified if an experiment or style change is desired. Plastic tools can help expedite and coordinate entire tooling programs.

Light weight for large dies is another advantage. One-piece parts of large size can be produced on presses now, where formerly great weight of metal dies precluded such manufacture. For example, a section of the skin for a transport barrel of Constellation aircraft, measuring 15 by 4 ft is produced on a 200 ton press. The phenolic plastic die used weighs 3500 lb. Such a tool of Kirksite would weigh 35,000 lb, and be extremely difficult to handle.

If wear occurs, repairs on plastic dies can be made quickly.

There are, however, certain inherent disadvantages that must also be considered. One of these is the necessity of a mold, since plastics are not machine-duplicated like steel; tools must be made in a mold or against a model. Toxicity: plastics used for dies are cured by catalysts that may cause skin irritation, some giving off strong fumes. This difficulty may be eliminated soon.

Most plastic dies have limited life, depending on complexity of the part. Plastics are not hard enough for some applications, though fillers and inserts may be added to increase abrasion resistance.

There are four areas in which cost of dies can be measured:
(1) Cost of material; (2) Cost of Fabrication; (3) life of the die; (4) time factors. Cost of materials and methods is difficult since technique is important in using plastic dies to best

advantage. However, in many specific instances cited, costs of diemaking have been substantially reduced, as much as 50 percent and there was a considerable advantage in the time factor.

From a paper given at University of Wisconsin Tool Engineering Institute, Sept. 1955.

▼ ▼ ▼

Aircraft Industry's Needs in Contour Machining

By W. B. MacKay
Supervisor Machines & Methods Development
Douglas Aircraft Co., Inc.
El Segundo, Calif.

Since most aircraft production is for limited quantity, tooling expenditures are a major problem. Facilities expenditures have risen to overcome tooling problems. Large expenditures, however, are not the answer to aircraft problems and if war were to come, machine tool builders would be unable to produce machine tools needed.

The aircraft industry cannot and the government does not want to buy enough large skin mills and other major equipment to mass produce contoured skins. It is more reasonable to produce a special machine for the job for a fraction of the cost of a major skin mill. Accelerated aircraft programs would require great quantities of money and time to provide additional mills needed. Special contract machines can be built in any good shop during emergency.

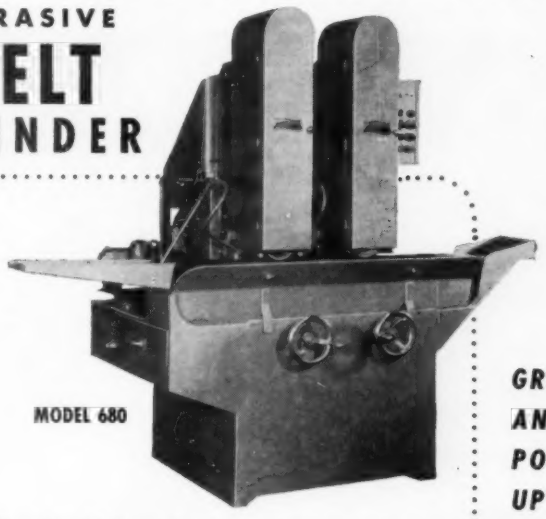
To prove the point, Douglas El Segundo has designed special contract equipment for single skins, integral milled complicated spars, long extruded parts, etc. It is now building two special deep cavity twist contour contract machines for large half-moon integral frames. This equipment is produced at a fraction of the cost of available equipment.

These point up the fact that a $250,000 skin mill is not required to produce a 4 x 8 ft skin. To prepare for any emergency, the government should stockpile standard components, such as hydraulic tracer valves, fluid motors, power units and other standard items needed for special machines. This would insure availability when and if an emergency arises. Meanwhile, hydraulic tracer controlled special equipment will become commonplace as the only answer to many aircraft machining problems.

From a paper given at the Contour Machining Conference sponsored by True-Trace Corp., El Monte, Calif., Oct. 1955.

New ENGELBERG

MULTIPLE-HEAD, CONVEYOR-TYPE
ABRASIVE
BELT
GRINDER



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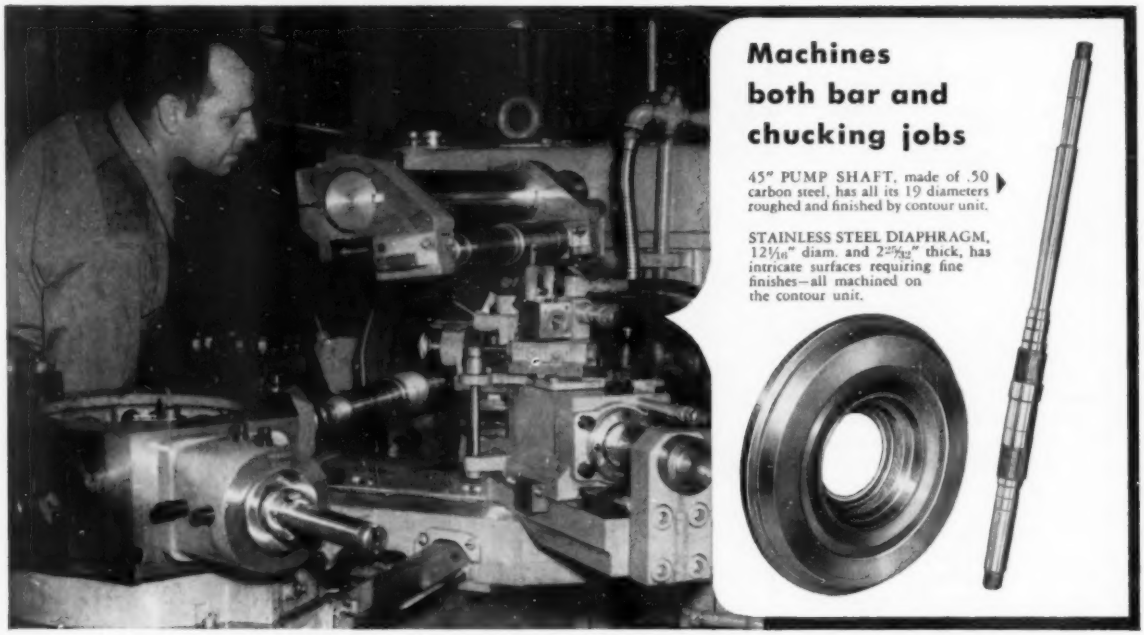
DOES FULL DAY'S WORK IN 66 MINUTES!


Machines both bar and chucking jobs
45" PUMP SHAFT, made of .50 carbon steel, has all its 19 diameters roughed and finished by contour unit.
STAINLESS STEEL DIAPHRAGM, 12 1/16" diam. and 2 27/32" thick, has intricate surfaces requiring fine finishes—all machined on the contour unit.

J. S. COFFIN, JR. COMPANY, Englewood, N. J. accomplished this startling time reduction on the 45" pump shaft, shown above. They transferred it from a fairly new standard turret lathe to a 2-A Extra Heavy Duty Turret Lathe equipped with Warner & Swasey's new Contour Unit.

This shaft, for their boiler feed pumps, has 19 different diameters, with as little as .010" difference between some adjacent diameters. It also has a taper and four Class 3 threads. Previously, it required 7 hours of machining on a standard turret lathe, using accepted turret lathe practice—indicating the money-saving advantages of this new Warner & Swasey Contour Unit.

Now the shaft is quickly cut down from 3¼" bar stock to finished diameters ranging between 1⅜" to 2⅞" using the separate rough and finish cutters in the hydraulically-operated unit's turret. It is roughed out with two and three cuts using the same cutter by simply flipping the tracer unit's leaf stops. A finish cut is then taken over the entire length of the shaft. From start to finish—only 66 minutes, including many other conventional cuts!

This unique contour unit also machines the intricate stainless steel diaphragm shown, providing Coffin similar time savings.

Operators like the unit's fast setup, and the over-all ease of machine handling that results from the 2-A's automatic head shifting. After pre-selecting his speeds, and pushing the master lever, an operator can position tools for the next cut while the head automatically shifts.

This story shows the time and money-saving possibilities this new, versatile combination of turret lathe and contour unit opens for you. For the complete facts on how it can cut costs for you, call in your Warner & Swasey Field Representative.

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Bodine CASE HISTORY NO. 42

HEADLIGHT ADJUSTING SCREW ASSEMBLY SPOTLIGHTS VERSATILITY OF BODINE METHODS

This is but one of many ways in which versatile, time-tested Bodine basic machines and units can be teamed to create high-speed, cost-cutting assembly units without resort to costly "specials."

Note especially the ease and convenience with which auxiliary equipment (in this case automatic hopper feeds) can be grouped around the Bodine "chassis." Note also the high production and close limits maintained on this day-in, day-out production line job for one of the world's largest automobile manufacturers.

PRODUCTION: 3,000 completed assemblies per 50-minute hour. Machine speed, 30 strokes per minute.

1

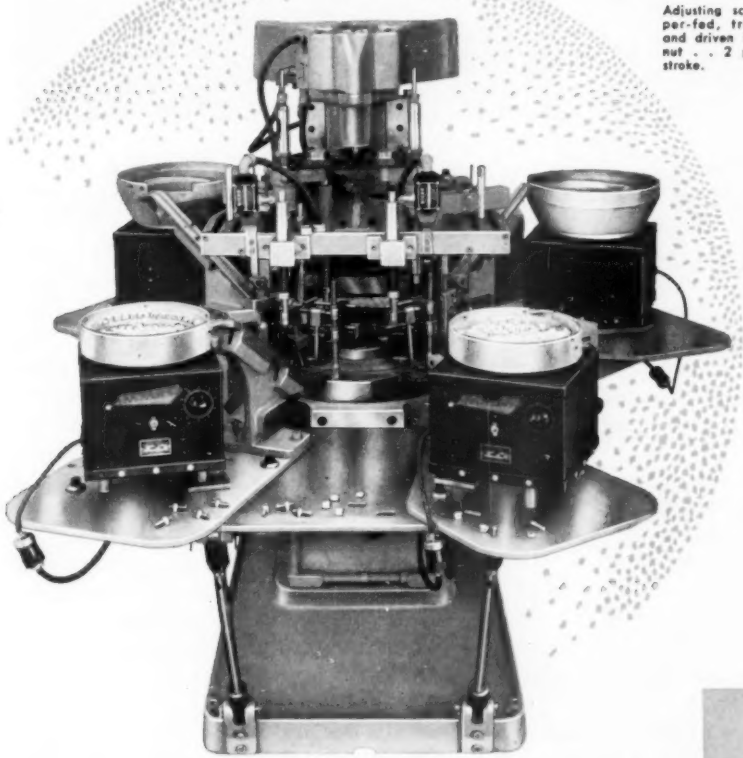
Unthreaded molded nylon nut hopper-fed and transferred to the dial fixture . . . 2 pieces per stroke.

2

Adjusting screws hopper-fed, transferred and driven into nylon nut . . 2 pieces per stroke.

3

Auto eject completed assembly. Depth of screw driving held consistently within ½ turn in untapped nut.



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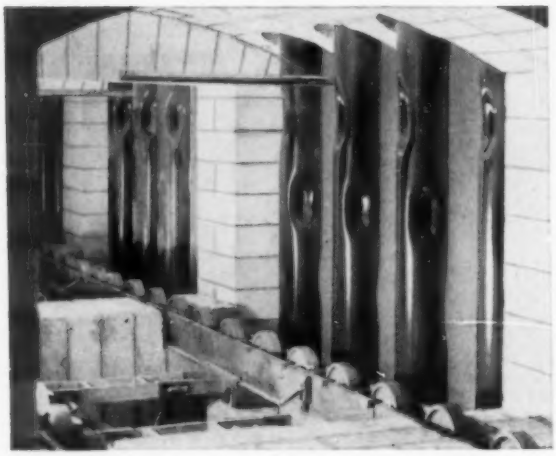

. . . IN THE GAS-FIRED FURNACE

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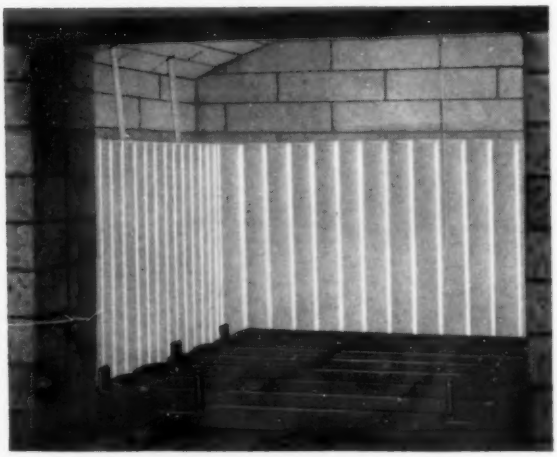
Because of its revolutionary design, this tube provides a new level of gas-fired furnace performance. The secret lies in the new Lindberg tube's "dimples." The tube carries a central stream of mixed air-and-gas surrounded by a cylindrical stream of air alone. Combustion occurs in the area between these two streams. The "dimples" create eddies accelerating combustion and maintaining even temperatures along the entire tube.

This Lindberg tube will operate at maximum efficiency for a longer period of time. The special protective coating gives greatest possible resistance to carbon penetration. Vertical position eliminates soot deposit and resultant temperature increases at points of sooting.

Tubes are 59 inches long, weigh only 29 pounds, changeable in a few minutes. No costly furnace shutdowns nor high labor and material cost for tube changes.



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The outstanding feature of the CORRTHERM element is the extremely low voltage at which it operates. Consequently, leakage through carbon saturation and shock or short hazards are eliminated. Elements also act as baffles to direct circulation of convection streams.

CORRTHERM elements are practically indestructible. Work load or operator's charging tool can't hurt them. Watts density is at all time low. Easily installed or replaced, too, as element merely hangs in furnace and no complicated mountings are required.

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Part.....Spec. Cap Screw	Length.....4 17/32" Cutoff 2" Thread
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Tools.....100% Carbide Tipped	RPM.....885 Work Spdl. 580 Th'd Spdl. 1465 Total Eff'd.
Material.....8742	
Stock Size.....1" Across Flats	Time.....14 Secs.

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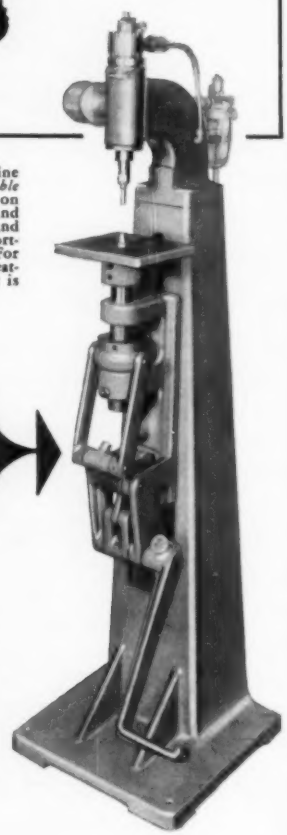

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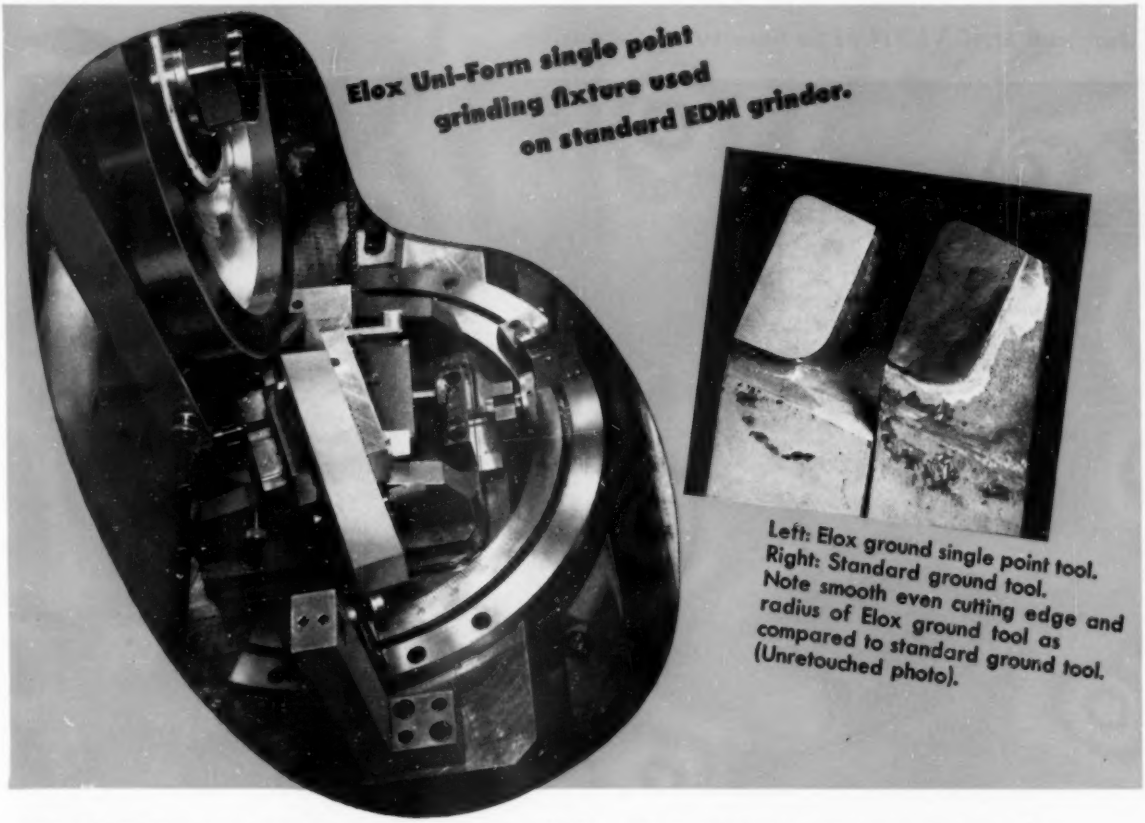

Left: Elox ground single point tool.
Right: Standard ground tool.
Note smooth even cutting edge and
radius of Elox ground tool as
compared to standard ground tool.
(Unretouched photo).

grind 2 faces and radius on 1/2" x 1" carbide insert in 3-1/2 minutes automatically . . . repetitively . . . without variation . . . without heat checks . . . without manual assistance!

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Grinding is done with a brass wheel to any pre-determined specifications. Every tool repetitively uniform!

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- **Permits use of standard blanks**
- **Every tool is identical as to radius, finish**
- **Increased tool life**
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- **Eliminates diamond wheels**
- **Carbide and tool shank are ground simultaneously**
- **Averages 40% labor savings**

See Elox Uni-Form Single Point Tool Fixture in operation at Elox Demonstration Centers.

Elox Electron Drill equipment for removing broken taps, drills, etc., from $495 to $3450.

*T.M. Reg.

Made with MAGNESIUM for better stretch-forming.

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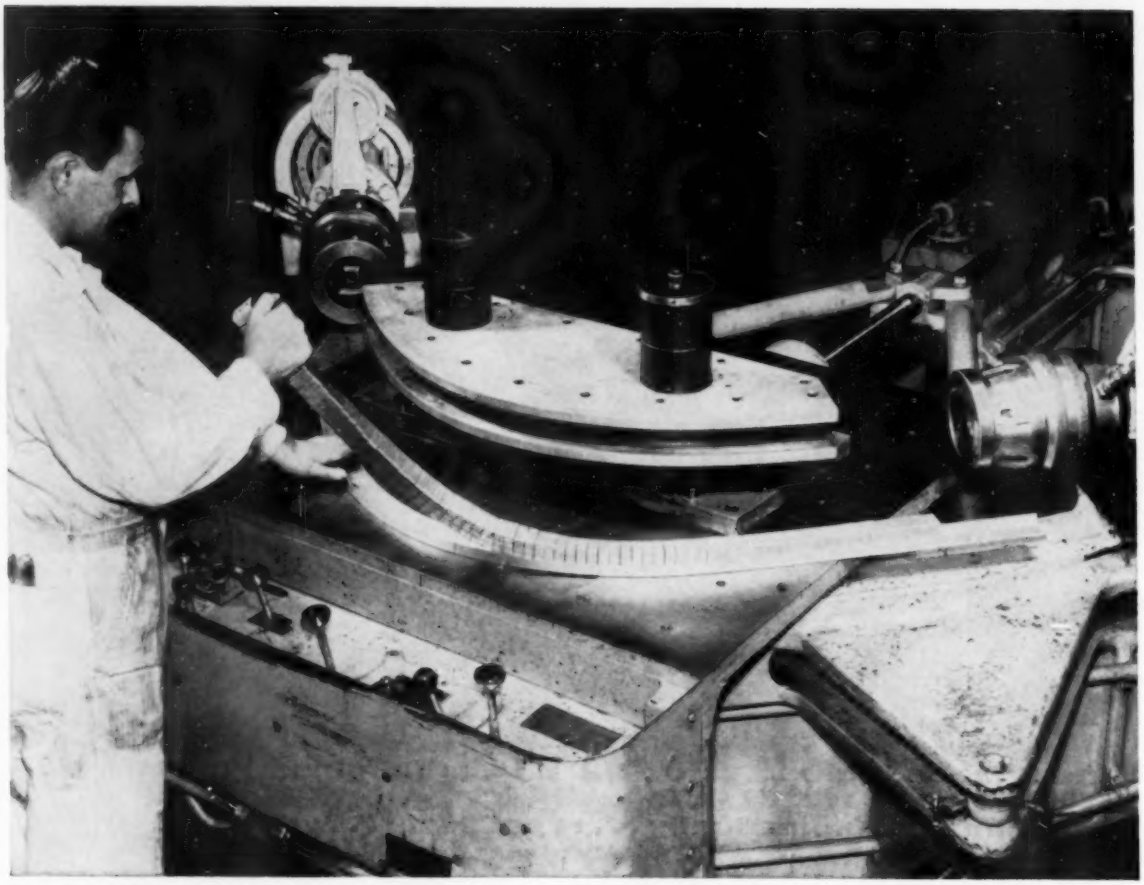

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Ready availability and lower prices complete the magnesium tooling plate picture. It's a picture you should look into to solve your own tooling problems! For further information, call your nearest Dow Magnesium Distributor today or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA 369L.

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The "214" automatically feeds, inserts and clinches two rivets at a time . . . with speed that may mean a big saving in your fastening costs.

14" throat makes large assemblies easy to handle. For up to 9/64" diameter steel tubular rivets—lengths to 3/8". Quick Change Rotary Type Hoppers and Raceways permit a 5-minute changeover to rivets of different size. Adjustable anvils and riveting centers add to its versatility.

Ask us how the "214" can help you cut costs. Send a sample of your problem assembly (or blueprint) for a Free fastening analysis.

FREE CATALOG contains valuable engineering information and rivet specifications plus illustrated descriptions of 26 Chicago Automatic Rivet Setters.

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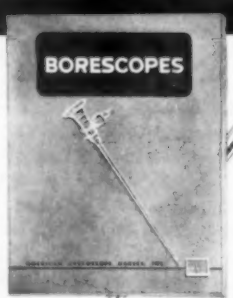

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These cutters can be furnished in various diameters and thicknesses to meet the requirements of individual applications.

Saws and cutters, both carbide tipped and solid carbide, will aid production and precision in your slotting, venting, slitting and grooving operations . . . and they will be manufactured to your specifications. Please furnish complete specs and quantities desired when requesting prices and indicate material to be cut. MEYCO experience in the manufacture of precision tools, since 1888, is at your disposal. Write for Bulletin No. 52.

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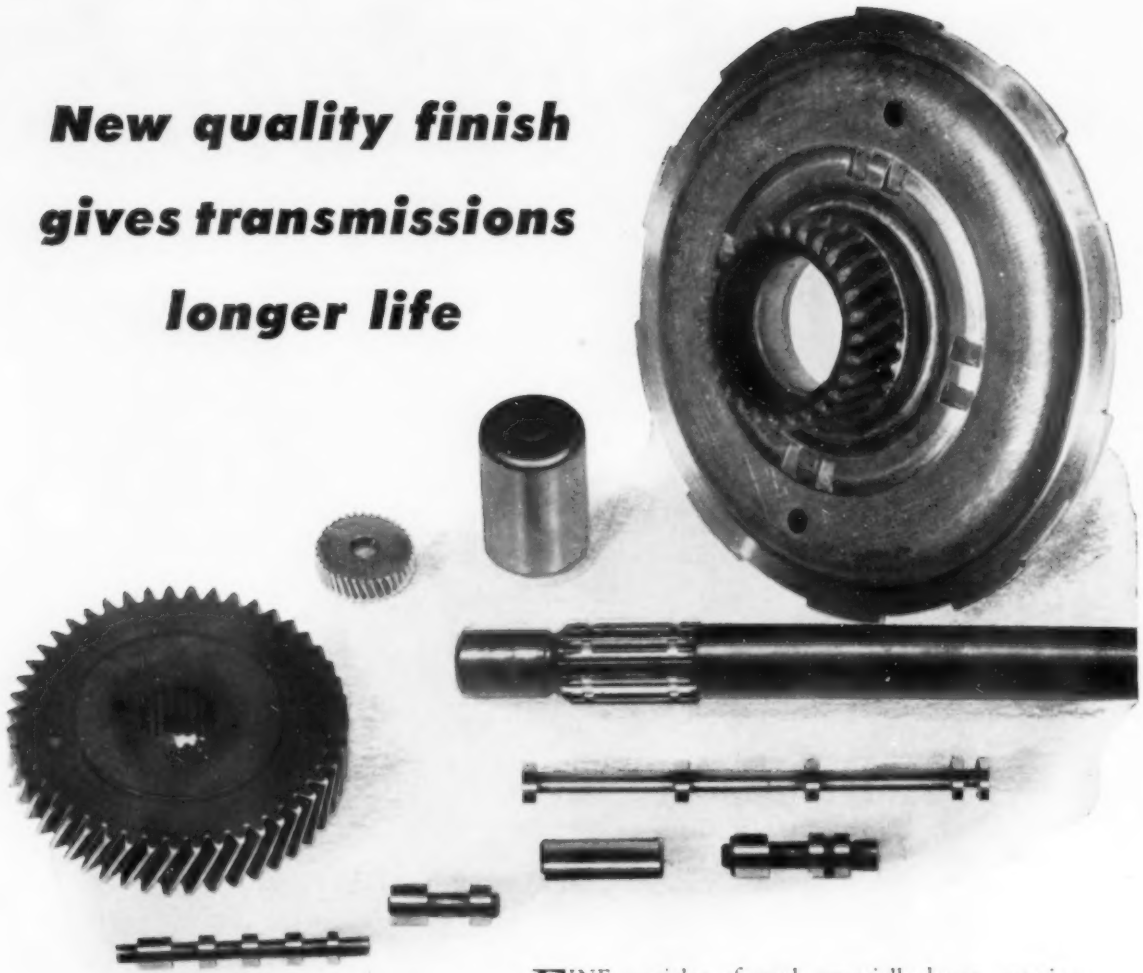
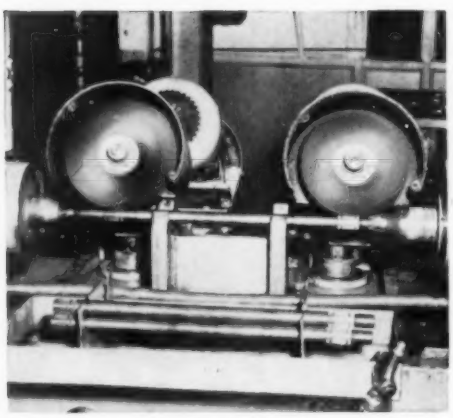
New quality finish gives transmissions longer life



FINE particles of steel, especially burrs, entering complex automatic transmissions cause excessive wear, possible failure.

Automatic, production-line brush finishing equipment, as found in major automotive plants, removes all burrs from precision-fitting transmission parts. In addition, it produces microinch surface finishes never before achieved . . . to increase transmission life.



Transmissions are one of thousands of products whose quality is improved through Osborn's power brush finishing. Yours can be another. Write *The Osborn Manufacturing Company, Dept* **K-20**, *5401 Hamilton Avenue, Cleveland 14, Ohio.*

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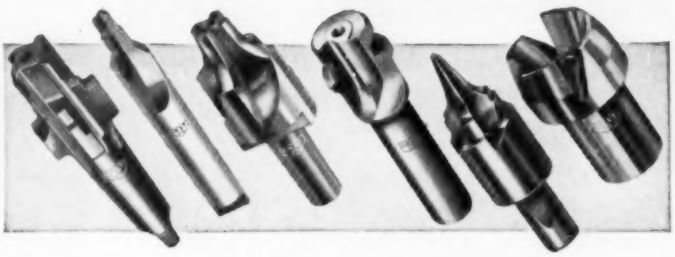
The Detroit Reamer & Tool Co. Plant is equipped with the finest in modern machinery and inspection facilities to provide you with the ultimate in precision tools. Our Engineering and production personnel with 35 years of empirical knowledge behind them are completely qualified to expertly handle your tool needs.



Grip-Tip CENTERS with Replaceable Carbide Tips

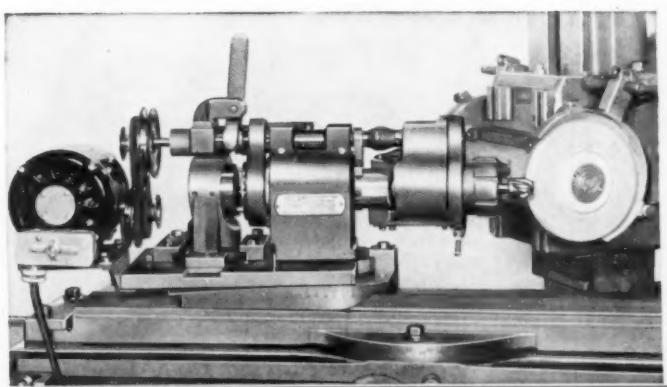
CHECK
THESE
Grip-Tip FEATURES
● Long-Life Holders
● Replaceable Carbide Tips
● Easy Insertion and Removal of Male or Female Tips
● Reduced Machine Down-Time
● Lower Cost for Replacement of Carbide Tips
● Carbide Tips Accurate to .0003"
● No Regrinding of Holder
● Carbide Tips Are Easy and Inexpensive to Stock
● Reduced Regrinding Time
● Longer Diamond Wheel Life

Grip-Tip Centers are designed to substantially reduce your replacement costs and machine downtime for regrinding or replacement of worn or chipped centers.

Male or female tips are inserted or removed from tool steel holders by simply turning clamping screw . . . you save replacement time.

The life of Grip-Tip holders is practically unlimited . . . only the tips are reground. Also, double end tips are relatively inexpensive . . . they reduce tool and inventory costs.

It takes but a minute to remove and replace tips . . . machine tool downtime is less with Grip-Tip.



Circularity-Grinding Attachment illustrated permits your own tool makers to quickly and easily answer your production requirements for new cutting tools. With this attachment, new cutting tools can be quickly cut from raw stock, old tools converted to meet new requirements or standard tools reground to your specifications. The Circularity Grinder is of inestimable value when emergencies exist, demand for a new tool is urgent or production lines must be kept running. With this attachment in your shop you eliminate delayed deliveries.

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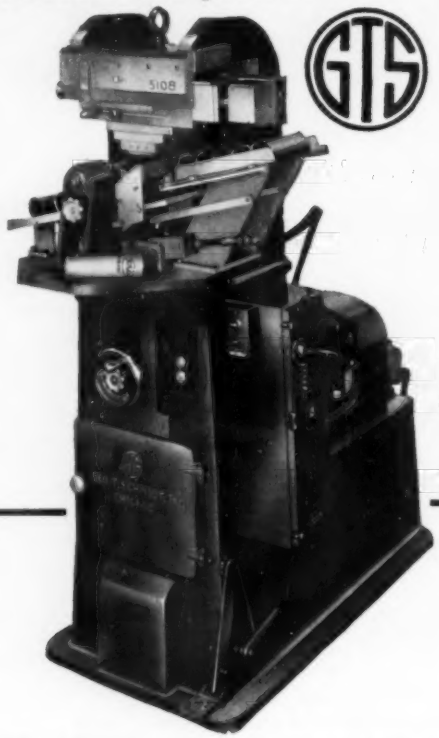
Mean faster, more uniform, less expensive identification of products and parts . . .



This high-speed, fully automatic tube marker is typical of GTS-designed production marking machines. It rolls a trade mark and part number on mild steel thin-walled tubes—*2500 to 3000 of them per hour*—making all impressions clean, accurate, and exactly uniform. It speeds production and cuts costs for a major automotive manufacturer.

This machine, or another unit of the extensive GTS line of Production Marking Machines, can reduce cost and increase production in your marking operations, too. To find out how—at no obligation—write today for an appointment with a GTS Sales Engineer.

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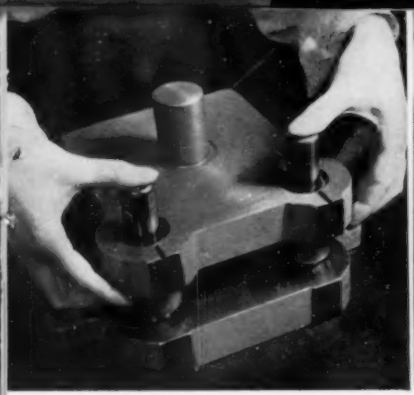

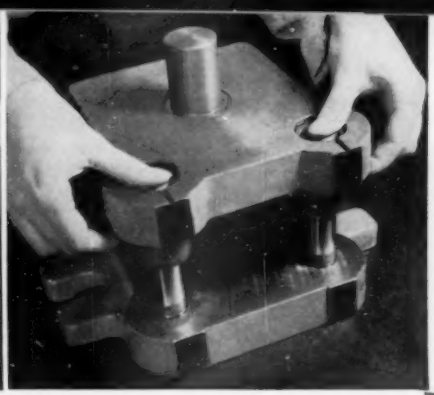

Here's a real test for quality...if you can make the punch holder glide up the pins just by squeezing—and hold its position without sinking back—it shows that the fit between pins and bushings is well-nigh perfect. The "finger-tip" action is typical of all DIECO die sets small enough to squeeze this way...and the larger ones are just as perfectly fitted.

What does "quality" in a die set mean to you?

If it means a perfect fit between pins and bushings...shoes that are absolutely parallel and stay parallel under load...*all* parts finished to precise tolerances with such unfailing regularity that there is never any variation in accuracy and serviceability among different die sets from the same source...then it stands to reason you must already be a user of DIECO die sets.

- Hardened steel pins superfinished and individually gaged to 0.0002" tolerance.
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- 1728 combinations in steel or semi-steel; interchangeable parts speed delivery.

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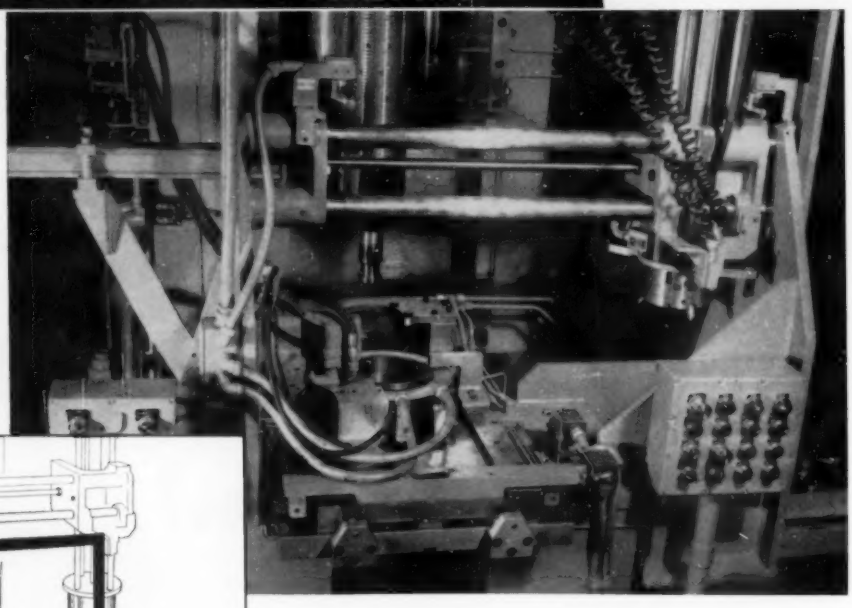
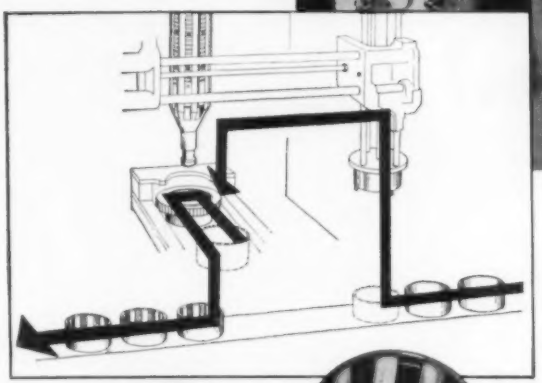
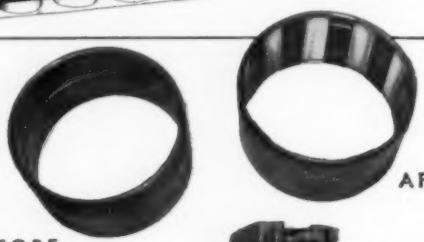
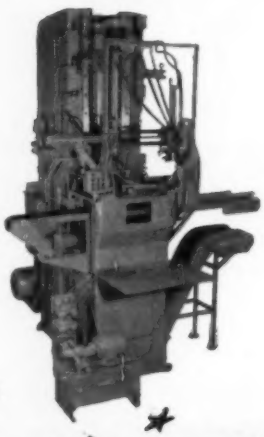






BEFORE AFTER

American 30 ton—60" stroke pull down broaching machine with full follow-up broach retriever, continuous belt conveyor and automatic chip conveyor.



American engineering solved this automation problem with a hydraulically operated loading mechanism, with an internal chucking device, that picks up the brake drums from a conveyor and inserts them in a collet-type work-holding fixture. The fixture automatically clamps the part and moves it into broaching position. The broach is then pulled down through, broaching 10 splines in the cast iron part. As the fixture slides back to loading position, the part is automatically ejected to the same conveyor line from which it was picked up.

Economical tooling is another feature of the machine. As shown in the simplified cross section at right, an arbor mounts ten sectional surface broach assemblies, which can be easily removed for sharpening and replacement.

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ASK FOR CATALOG 450. ***It's a complete broaching manual.***

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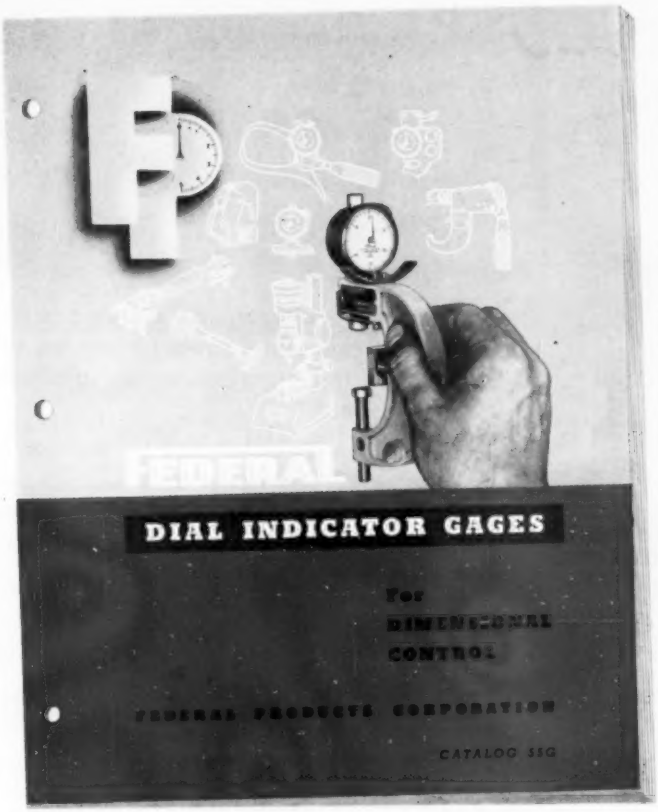

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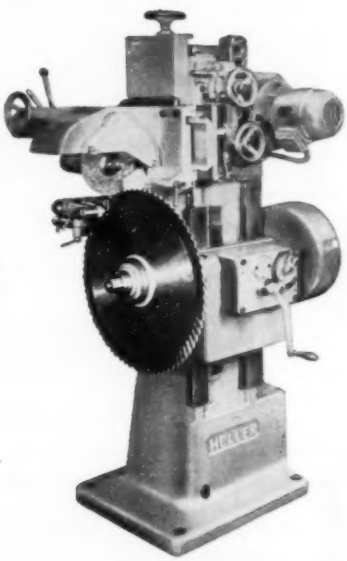
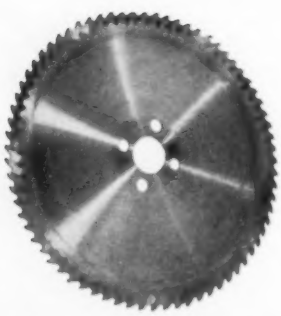


MODEL B-650
AUTOMATIC SAW SHARPENING
MACHINE



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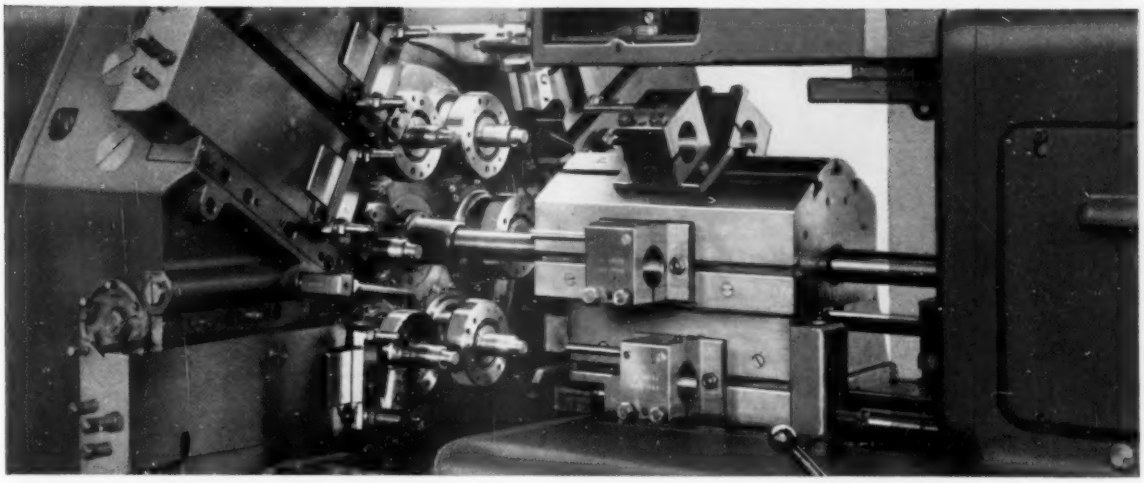

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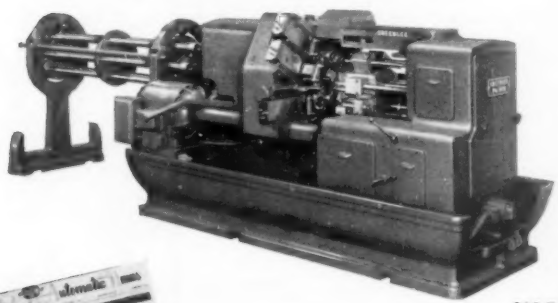

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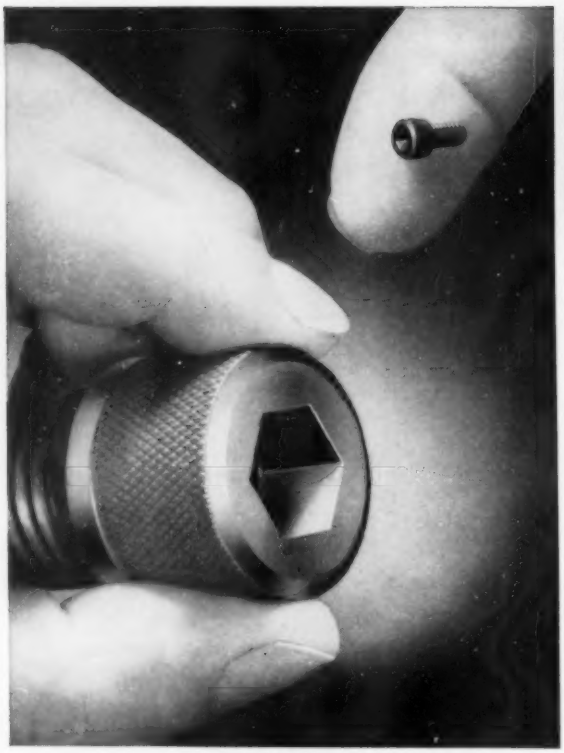

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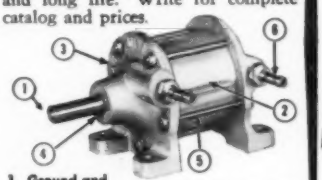
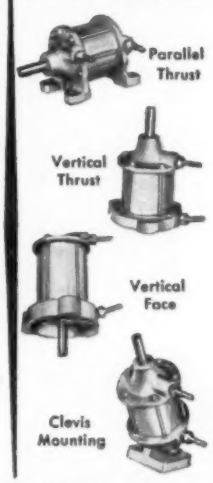


1. Ground and polished steel ram
2. Brass, true-bore cylinders
3. High strength aluminum alloy cylinder heads
4. Bronze oilless ram bushing
5. Five steel tie rods
6. Brass hose stems

4 Mounting Types



AIR-MITE Devices, Inc.
4418 W. CARROLL AVENUE • CHICAGO 24, ILLINOIS

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MICROBORE BOOTH 421
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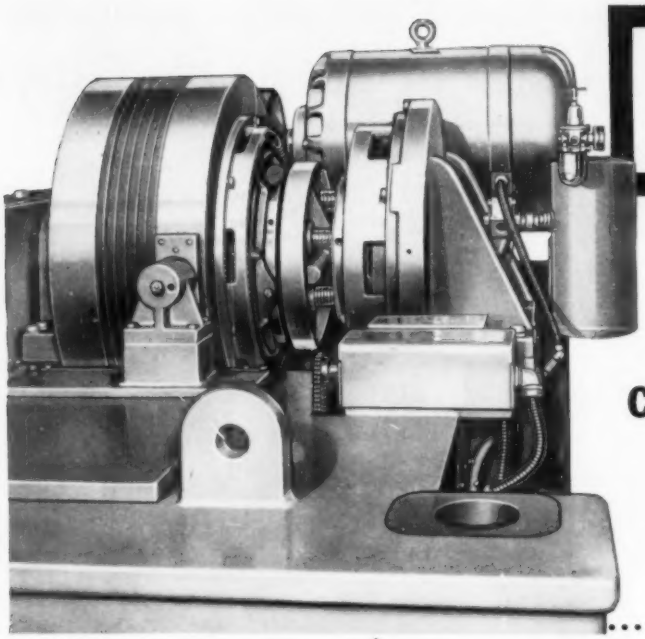
The DeVlieg Microbore exhibit will include a wide range of Precision Tooling for general purpose and production applications

DEVLIEG MICROBORE CO.
2720 West Fourteen Mile Rd., Royal Oak, Mich.



These are the features **that make -Verson- presses your best buy**

THE Verson CLUTCH AND BRAKE UNIT

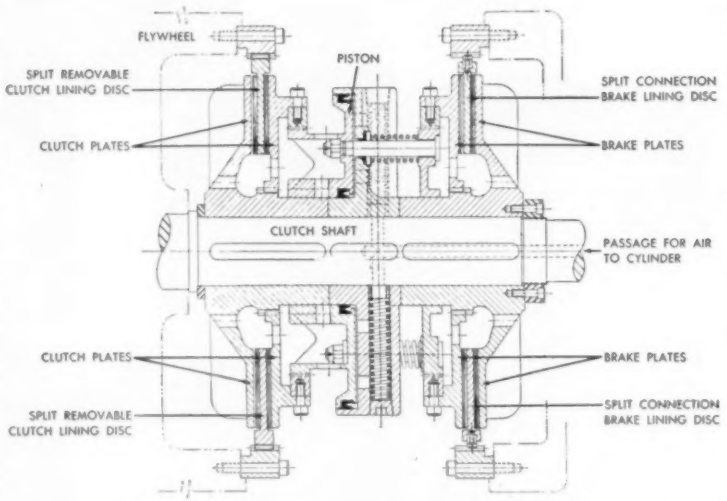
No tricks— just top notch performance

The drawing at the right shows the construction and operation of the Verson clutch and brake unit.

With the clutch disengaged, powerful brake springs clamp brake plates against the stationary brake disc. The brake disc is mounted to the press frame in a manner that will permit axial motion but will oppose rotation.

To engage the clutch, air is admitted to the operating cylinder through a passage in the drive shaft. This forces the piston out, compressing the brake springs and releasing the brake. Further motion of the piston engages the clutch thereby transmitting the motion of the flywheel to the clutch shaft.

When air pressure in the operating cylinder is released, the brake springs pull the piston back, first disengaging the clutch and then engaging the brake.



The Verson Pneumatic Clutch and Brake Unit is the heart of Verson mechanical presses. It is a mechanically interlocked type which eliminates all possibility of overlap between clutch and brake. Drag cannot occur, efficient power application is assured and wear on clutch and brake linings is minimized. Shock and vibration are also minimized for longer press life. This is no trick clutch . . . it is a soundly designed unit that has been proved in countless hours of abusive tests and years of field experience.

The Verson Pneumatic Clutch and Brake Unit is just one of many reasons why it pays to specify Verson Presses for your requirements. We'll be happy to tell you the whole story. For specific recommendations, send an outline of your requirements.

Ask us about our new customized installment and leasing programs.

A Verson Press for every job from 60 tons up.

TRADE Verson MARK

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

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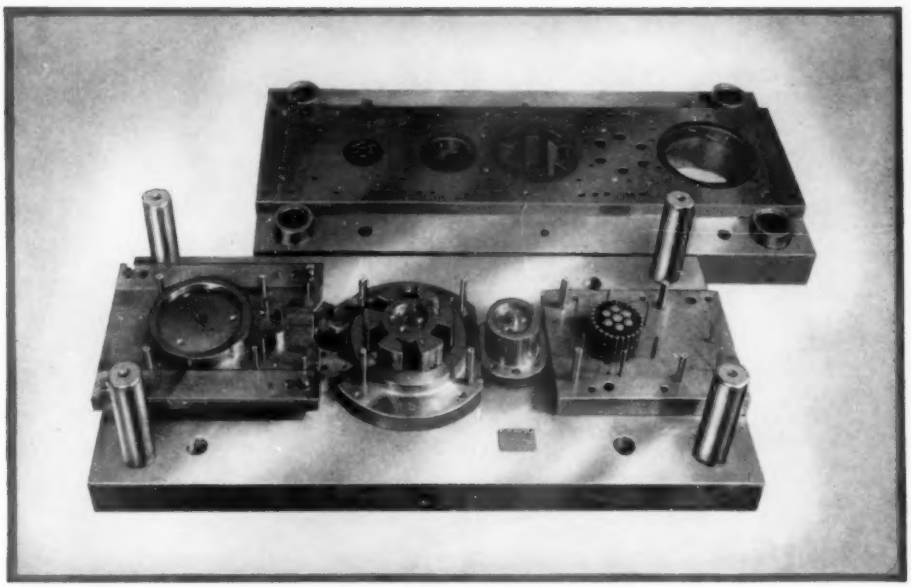
MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

Although a steel die costs
less initially, this . . .

Carbide-equipped die pays off by outproducing steel die 10 to 1



Precision lamination die, equipped with Carboloy cemented-carbide cutting edges. Produces one million rotor and stator parts per grind, compared to only one hundred thousand per grind with a steel die.

The initial cost of this lamination die equipped with Carboloy® cemented carbide is about twice that of a steel die. But because the carbide die produces 10 times as many parts per grind, the initial investment is more than returned in downtime and grinding savings alone.

This is what the 10 to 1 ratio means to a plant: grinding expense reduced 90%; downtime reduced 90%; output per shift increased; grinding facilities freed for other tasks; scrap reduced because the carbide die holds its accurate tolerances longer; costly finishing work eliminated because parts are burr-free.

Actually, this case history is one of the less spectacular recorded on dies equipped with Carboloy cemented carbide. On many applications – large and small, simple and complex – carbide dies outproduce, outlast steel by margins as high as 50 to 1.

No matter what the job – drawing, forming, blanking, or piercing – Carboloy carbide-equipped dies have more than proved their value. Consult a Carboloy Engineer today. He will be happy to work with you or your diemaker on design and application problems. For more information, write or send the coupon below.

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- ☐ Send complete details on Carboloy Die Training School.
- ☐ Have a Carboloy Die Engineer call at my plant.

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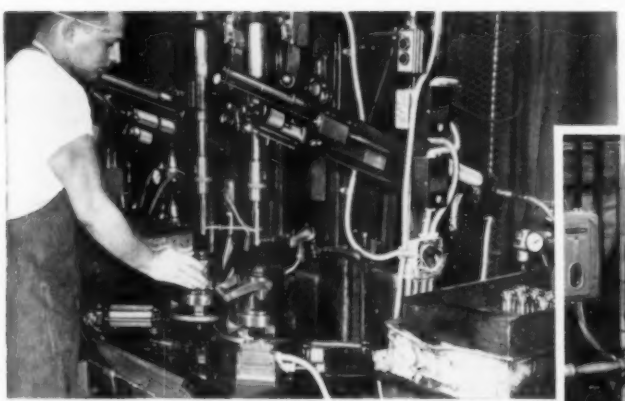
UNIQUE AIR CYLINDER WITH BUILT-IN ELECTRIC VALVE EASILY INSTALLS ON ANY MACHINE

Known as

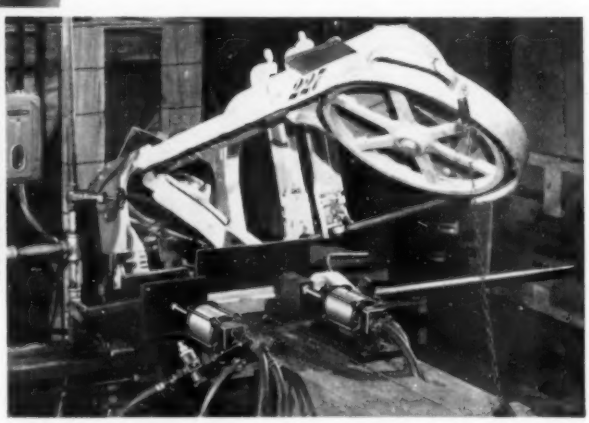
The Bellows Air Motor

it features

- **Built-in Directional Valve**
- **Built-in Speed Controls**
- **Only a Single Air Connection**



Drill Press Feed powered with Bellows Air Motor makes any standard drill press a fast semi-automatic machine.



Standard cut-off saws quickly converted to automatic operation with two Bellows Air Motors.

OFTEN CUTS COSTS 50% OR MORE

Changing a hand fed machine into a fast semi-automatic or automatic unit right in your own tool room is a cinch with the Bellows Air Motor—the unique air cylinder with all controls built-in.

The Bellows Air Motor is a complete work unit in itself. Directional valve, high or low voltage electric valve operating control, and precision speed controls are all built-in. You require only a single air connection—and that can be made with flexible hose.

Two, three—(or as many as you wish) Bellows Air Motors can be electrically interlocked to work in timed sequence to perform related operations with whatever precision you require.

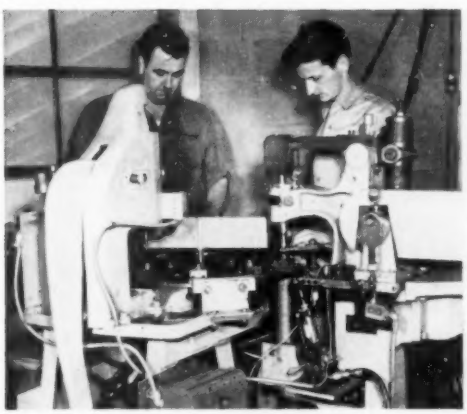
Bellows Air Motors are ruggedly built, precision-machined, to give years of trouble-free service. Records of twenty—thirty, even fifty million cycles are quite common. And Bellows nation-wide service (more than 100 field engineers in industrial areas of the United States and Canada) assures you of quick competent help in the application of Bellows Air Motors to your specific problems.

Write TODAY for this NEW four-color booklet

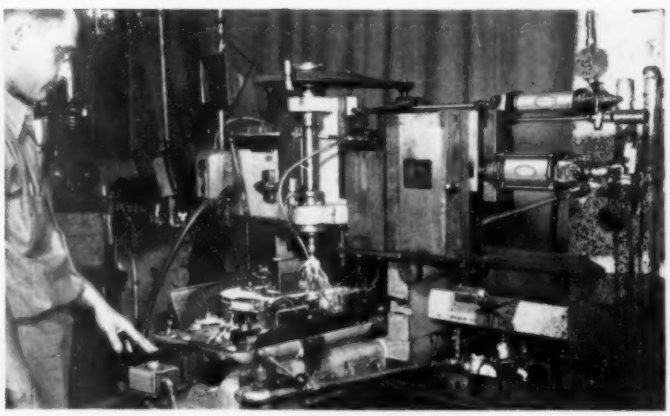
The story of Bellows Controlled-Air-Power and how industry everywhere uses it to find lower-cost ways of doing jobs better. Address Dept. TE256 The Bellows Co., Akron 9, Ohio. In Canada: Bellows Pneumatic Devices of Canada, Ltd., Toronto.

The Bellows Co.
AKRON 9, OHIO

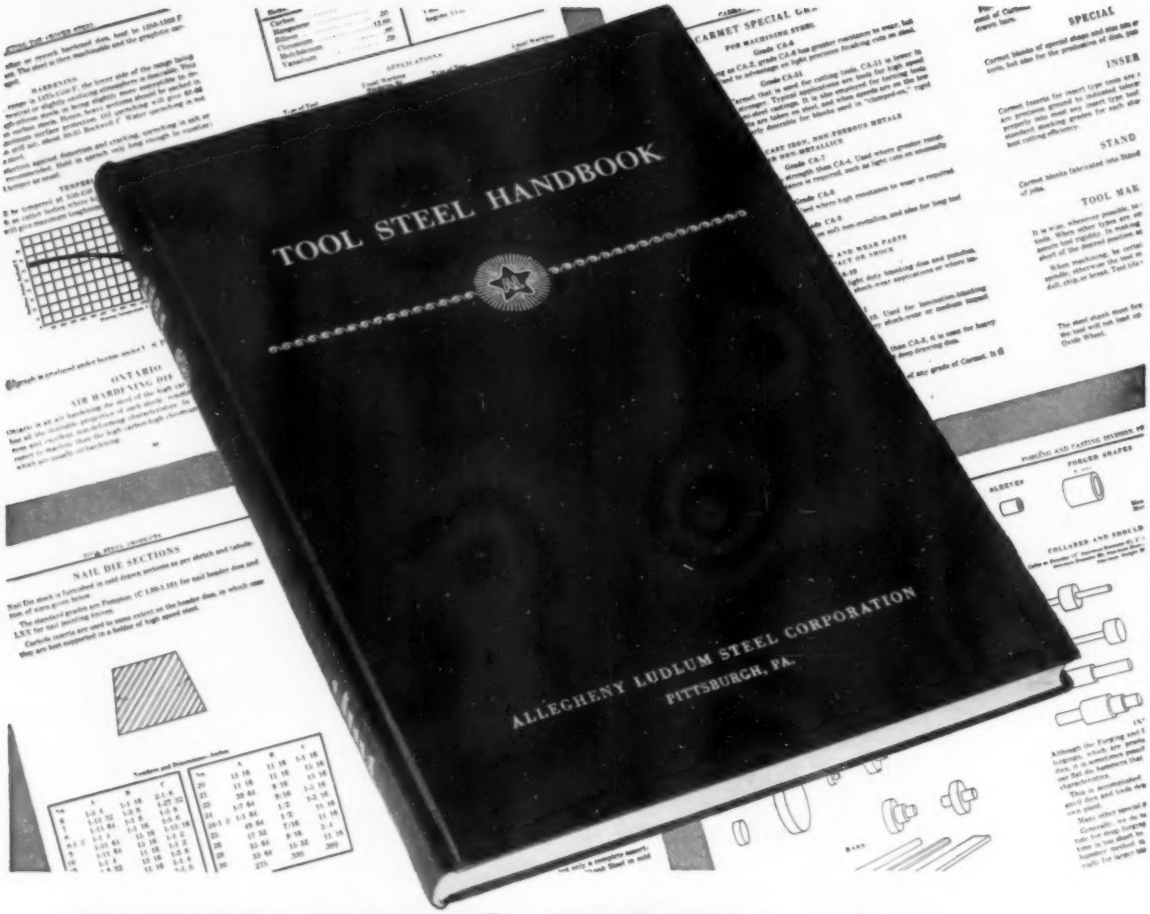
1282A



Kick press powered with Bellows Air Motor equals output of **5** foot-powered presses.



Three Bellows Air Motors turned this obsolete milling machine into a high producing unit.



AVAILABLE NOW—196 pages of Valuable Tool Steel Information

Another printing of our Tool Steel Handbook—one of the most comprehensive treatises of its kind ever offered by a tool steel producer—is just off the presses. In addition to a relatively complete picture of Allegheny Ludlum Tool Steels, their properties, applications and the forms in which they are available, this 196-page case-bound book presents an extensive discussion of heat treating and handling techniques as well as a complete set of weight tables and other useful reference material.

Your copy of the Tool Steel Handbook will be sent—*without charge*—upon request. Our only stipulation: please make your request upon your company letterhead. ● Write to *Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pennsylvania.*

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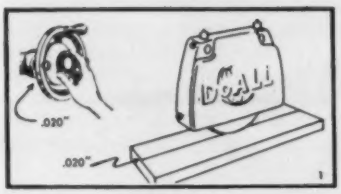
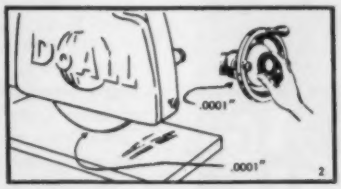
Can Your Grinder Meet The Test?



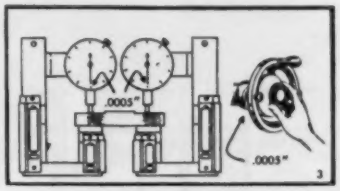
NO SPARK-OUT

1. Take a .020" cut with .020" crossfeed in 59-60 RC tool steel. A DoALL Grinder will run back through the cut with absolutely no spark-out!



ERASE PENCIL MARK

2. Now, put a pencil mark across the cut. Feed down .0001" and run the wheel through the cut again. A DoALL Grinder will erase the pencil mark!



DUPLICATE DIMENSION

3. Downfeed .0005" and grind ⅓ the width of the workpiece. Do the same to the opposite ⅓ of the surface. Both cuts will check out at .0005" when done on a DoALL!

WHAT FEED SETTING SAYS— DoALL GRINDER DOES!

If the downfeed calibrations of your grinder do not represent an equivalent amount of stock removal, then you are paying a premium for the work it performs. It is a costly waste of time to grind, and measure, then grind and measure repeatedly, to reach a desired dimension. Try the above test on your grinder. Then ask to see the same test on a DoALL Grinder. You'll see why grinding time on a DoALL is productive time!

Free demonstrations—Here you see men who had never before operated a grinder, remove stock exactly to downfeed settings by following simple instructions. Call your nearest local DoALL Store or write The DoALL Company, Des Plaines, Ill., for a free demonstration. Let DoALL grinder performance speak for itself.

Free literature—Ask for the DoALL Grinder Catalog describing a complete line of hydraulically operated manual or automatic precision surface grinders with modifications and accessories for flat, cylindrical and form grinding work. Write or call DoALL today.

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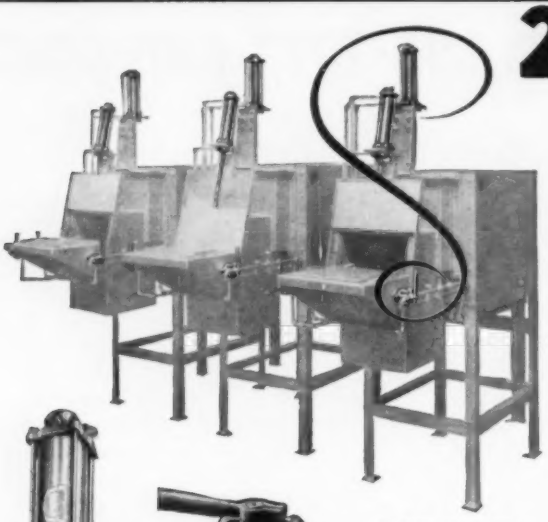
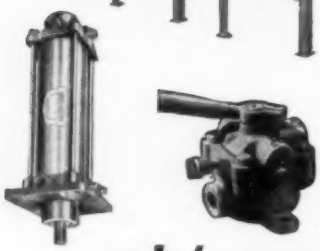
NEW FILMS: Color . . . Sound . . . Analysis "Techniques of Surface Grinding" and "Extending the Range of Modern Surface Grinding."

GR-15





20 YEARS Trouble-Free Service on Hevi Duty Electric Furnaces

Hevi Duty Electric Co., Milwaukee, builder of Electric Heat Treating Furnaces, has found that NOPAK Cylinders and Valves can be depended upon for the many years of trouble-free service which users expect of Hevi Duty Furnaces. Not once in 20 years has a Hevi Duty customer returned a NOPAK Component for replacement.

The furnaces pictured are used to harden steel dies employed in the manufacture of jewelry. Outer doors, inner partitions and conveyor trays . . . all are actuated by NOPAK Cylinders controlled by externally mounted NOPAK Valves.

Another reason why Hevi Duty specifies NOPAK Products is the simplicity and ease of their installation . . . an important factor in cutting assembly costs.

Examples showing how NOPAK Products are used in other types of machinery and equipment are described in the NOPAK Application Manual. Ask your NOPAK representative, or write for your copy.

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DESIGNED for AIR and HYDRAULIC SERVICE

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Multiform

BIG BROTHER BENDER

Produces Without Special Tooling—Saves Die Costs Saves on Expensive Presses

Model BB

Illustrated above are a few of the many forms that can be produced efficiently on the Multiform Bender using the standard tooling.

The heavy duty Big Brother Bender is designed for fabricating bus bars, brackets, fixtures, etc., without special tooling. Air controlled with finger tip response. Comes complete with dies, mandrels and wrenches—punching and blanking dies extra.

Will punch holes up to 1" and form material up to ¼" thick by 4" wide. We also build smaller hand or air operated models for forming up to ⅛"x1½" material. These machines are solving new forming problems in many plants and could be the answer to yours.

Send for illustrated folder TE-5

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J. A. RICHARDS CO.

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INSPECT DIMENSIONS with your Metron COMPARATOR GAGE

You get FOUR ranges in ONE low-cost all-purpose comparator... Easily gages to 10 millionths, 20 millionths, 1 ten thousandth or 2 ten thousandths of an inch. Use to gage external dimensions of parts having a variety of sizes and shapes.

Range calibrations are fixed and stable. No vacuum tubes, mechanical linkages or other limited-life components are used.

Manufactured by Metron since 1942. Formerly distributed by the DoAll Co. NOW SOLD DIRECT FROM METRON.

ALSO AVAILABLE

- Accessory kit for special gaging.
- Comparators to gage as little as ± one millionth of an inch or as much as ± 20 thousandths of an inch.

For details write for Bulletin 200.

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451 Lincoln St., Denver 3, Colo.

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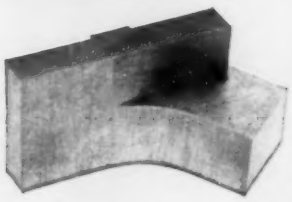
New DoALL SAW BAND CUTS FASTER in MACHINING SOLID STEEL SHAPES

PARTS SHAPED FASTER WITH Demon HIGH-SPEED STEEL SAW BANDS

NOW 60 min. with Demon Saw.
Was 100 min. with carbon steel saw.
Was 15 hours on shaper.

Product:
Double Knee Turner
1045 Steel



NOW 28 min. with Demon Saw.
Was 60 min. with carbon steel saw.
Was 8 hours on shaper.

Product:
Knee Turner
Steel

NOW 15 min. with Demon Saw.
Was 40 min. with carbon steel saw.
Was 9½ hours on shaper.

Product:
Shaving Tool Holder Slide
SAE1045

The revolutionary Demon High-Speed Steel Saw Band and its companion, the versatile Contour-matic Band Machine, make it possible to cut critical parts from solid steel or steel forgings faster than has ever been possible before!

DoALL Demon High-Speed Steel Saw Bands slice through the toughest steels up to 10 times faster and with up to 30 times longer life than carbon steel saw bands. This makes the proven world's fastest machining method even faster.

Since the contour sawing method wastes no time making chips out of valuable metal but cuts right to the layout line, removing unwanted metal in chunks, it is possible to maintain high standards of strength and quality in critical machine parts with a decrease in machining cost.

Ask for a demonstration. See Contour Sawing at its best — the DoALL Contour-matic with Demon High-Speed Steel Saw Bands. It's terrific, absolutely amazing and a definite means of making your machining operations more profitable.

Demon and Contour-matic are registered trade marks of The DoALL Company.

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SB-41

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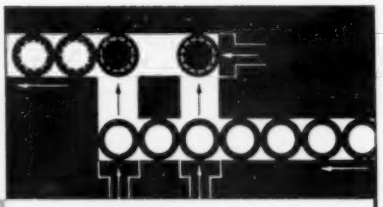
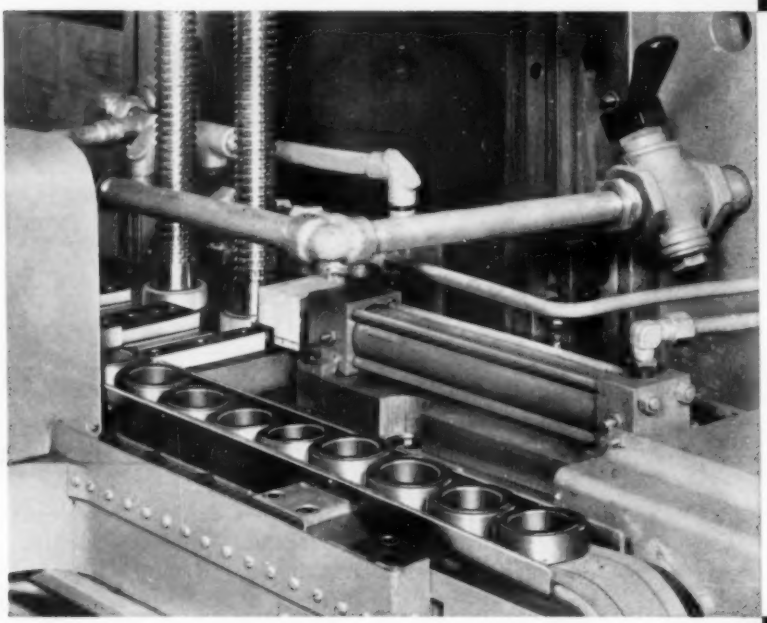
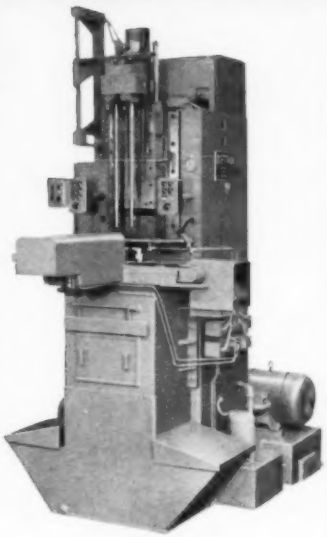
AUTOMATION IN BROACHING!







DETROIT BROACH PROVIDES FULL AUTOMATION WITH FLEXIBILITY OF MANUAL OPERATION

In the designing and manufacture of automatic tooling for this Pull Down Internal broaching machine, Detroit Broach combined all the time and labor saving advantages of automation, plus versatility to permit efficient manual operation when required. This standard machine is designed to support the tail of the broach throughout the entire stroke and, if desired, may be arranged to hold the tool in tension throughout the cut.

On this particular job, parts are loaded, broached and unloaded automatically—maintaining consistent, high quality production WITHOUT AN OPERATOR! Parts are fed to the machine fixture and then carried away on a belt conveyor.

In addition, this machine features:

OPERATION
Broaching 39 involute spline teeth and size minor diameter

PRODUCTION
480 pieces per hour (100% hour)

MACHINE
Detroit Broach 10-ton Vertical Pull Down Broaching Machine with 42" stroke.

1. An automatic safety mechanism which must be actuated by both broaches at the top of the stroke before the unloading cylinder will eject the finished parts. This eliminates any possiblity of costly tool breakage and down time.
2. Should anything interrupt this machine's automatic cycle, an operator can step in and run full production manually until automatic cycle is resumed.
3. Use of standard components wherever possible to keep costs low and to assure simple, time-saving maintenance or replacement.
4. Fixtures designed and built for greatest flexibility . . . for easy conversion to hold other parts or for design changes on present parts.
5. Simplicity of design and construction for convenient accessibility . . . for quick, easy inspection and maintenance.

Why not find out how you, too, can benefit from new broaching techniques and tooling advancements. Our sales engineers will be glad to consult with you at your convenience.

Detroit Broach COMPANY
ROCHESTER, MICHIGAN

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A Severance CARBIDE ECONO-SINK WILL GIVE YOU —
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Expanding • Grooving • Threading • Reducing
Double Lap Flaring • Double Lap Flanging

on Tubing up to 6" Diam.

THE VAILL ENGINEERING CO.
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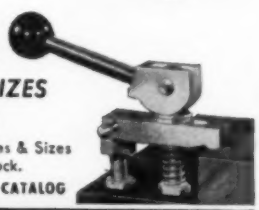
Note These Features—Reamed Holes—Hardened Serrated Bushings—High Tensile Strength Rivets

STANDARD FIXTURE CLAMPS
15 STYLES . . . 136 SIZES



COMPONENTS
Over 1000 different Types & Sizes available from stock.
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USE READER SERVICE CARD; INDICATE A-2-250-2

What TO DO ABOUT Oversize and Bell-Mouthed Holes!

Types to fit any machine used for tapping or reaming.

When tapping and reaming jobs come through with oversize and bell-mouthed holes, the trouble is not always the fault of the machine or the cutting tool. In fact, likely as not, it is caused by the work not being properly aligned with the spindle.

In the latter case, the remedy is simply to change over to a Ziegler Tool Holder which automatically compensates for inaccuracies in alignment up to 1/32" radius or 1/16" diameter.

On future tapping and reaming jobs try a Ziegler Holder and see how much better work your machines will perform.

PROMPT DELIVERY

W. M. ZIEGLER TOOL COMPANY
13574 AUBURN DETROIT 23, MICH.

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Ziegler ROLLER DRIVE FLOATING HOLDER for Taps and Reamers...

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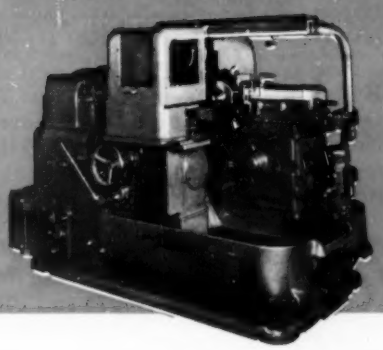
TAREX

AUTOMATICS

. . . here's JUST ONE of the salient features of this machine which is made with SWISS PRECISION throughout:

FOUR ROBUST SLIDES!

The front and rear slides mounted on crossed ways, *permitting radial or lateral movements, or combined to produce tapers or irregular forms.* This allows the use of single point tools in many cases in place of form tools with their inherent side thrust. All tool slides actuated by camming systems having adjustable ratios. (The two upper slides are radial only). Machine throughout is engineered to take American-made tools!



COMPLETE TOOLING and SERVICE in AMERICA.

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

ACTION PICTURE

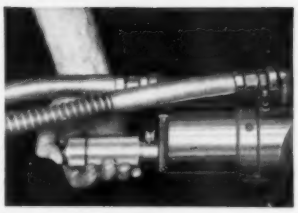
of how to save money by riveting!

This action photo, taken on the frame assembly line in one of the largest auto factories, illustrates how cost-conscious manufacturers save money with Hannifin "Hy-Power" Hydraulic Riveters.

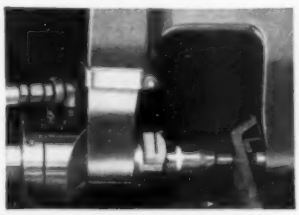
First step in assembly is to rivet the frame together...with Hannifin "Hy-Power" Riveters. The light-weight forged C-Frames hang from balancers within easy reach of each operator. No special skill is required to head the ⅜" rivets, cold, each in seconds. What's more, this "silent squeeze" method forms stronger, more uniform rivets, hot or cold.

Power source is the Hannifin "Hy-Power" Hydraulic Pressure Generator which quietly supplies pressure to the "Hy-Power" Cylinder that does the work. These riveters are available in 7½, 10, 12½, 17½, 25, 35, 50, 75 and 100-ton capacities.

here's the HANNIFIN "HY-POWER" WORK CYCLE



In position. A single control button starts (or interrupts) the automatic Hy-Power cycle.



Ram approaches fast, then hydraulic pressure automatically intensifies, and the rivet head is formed.

Fast, automatic return. Total elapsed time to head a rivet is only 2 to 3 seconds.

"HY-POWER" CAN ALSO BE USED IN MULTIPLE TO SET SEVERAL RIVETS

Bulletin 150 tells how to save money on riveting, staking, punching, forming and bending operations. Write for copy.

do ALL you can do...with

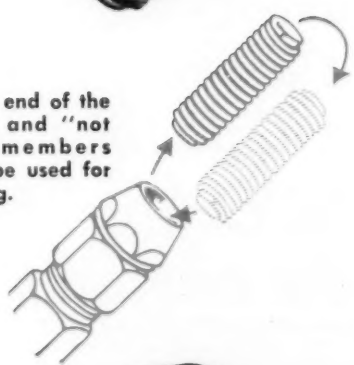
HANNIFIN

Hannifin Corporation, 519 S. Wolf Rd., Des Plaines, Ill.

Air and Hydraulic Cylinders • Hydraulic Presses • Pneumatic Presses • "Hy-Power" Hydraulics • Air Control Valves

2 FOR YOUR MONEY*

(..gages, that is)



* Either end of the "go" and "not go" members may be used for gaging.

You get twice the gage life with Bath Reversible Gages by reversing the gage members in the handle when they become worn. The same double value applies to Reversible Cylindrical Plug Gages.

Bath high standards of manufacture too, guarantee extra value . . . through every step of production to the final inspection of these quality precision instruments.

Any way you look at it . . . Bath Reversible Gages give you more for your money.

JOHN BATH & CO., Inc.

28 Grafton St., Worcester, Mass.

CYLINDRICAL PLUG AND RING GAGES • THREAD PLUG AND RING GAGES • THREAD MEASURING WIRES
MASTER SETTING DISCS • INTERNAL MICROMETERS • GROUND THREAD TAPS

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-2-253

For precision cleaning of molds and dies—

NEW PANGBORN HYDRO-FINISH

gives you: Fewer moving parts
Easier handling—Added efficiency

Now Pangborn's famous Hydro-Finish is yours with added convenience and efficiency! Holding fine tolerances, Hydro-Finish cleans molds and dies in minutes . . . offers many new advantages. Pangborn has done away with the pump; air jet sluriators now keep the abrasive in suspension. This means a lower investment and fewer moving parts. Optional loading stand simplifies handling, washing and inhibitor application. The cabinet has been redesigned for more efficient operation. These and other advantages make the new Pangborn Hydro-Finish ideal for precision cleaning and finishing!

For further details on Hydro-Finish, send for Bulletin 1403 now! Write: PANGBORN CORP., 4700 Pangborn Blvd., Hagerstown, Md.

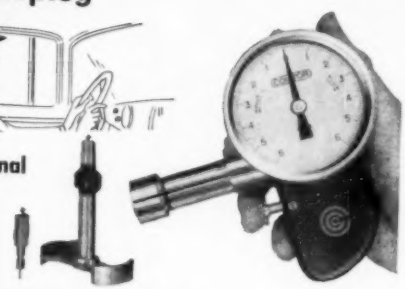
Pangborn

BLAST CLEANS CHEAPER

USE READER SERVICE CARD; INDICATE A-2-254-1

Did you know that---

The odds are 2 to 1 that the transmission in your new car was gaged by Comtorplug



Precision Internal Gage
SIZES FROM 1/8" to 8" AND LARGER

COMTORPLUG with interchangeable expanding plugs to gage simple or special bores from 1/8" to 8" dia.

UNIQUE ADVANTAGES

Positive gaging accuracy to fraction of .0001" regardless of who operates it.

Indicates actual size, a fixed—not passing—reading.

Positive 2-point gaging — automatic centering.

Shallow holes, deep holes, inside splines, open-end holes gaged easily.

Detects ovality, back or front taper, bell mouth, barrel shape. Reaches to bottom of blind holes

Gages work while still held in chuck.

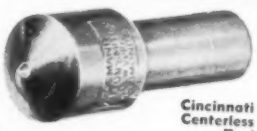
A shop tool for all-day everyday use.

Portable — no wires, hoses or stands.

Investigate the gage used by the thousands in jet engine, guided missile, farm machinery, automotive transmission, household appliance, and other volume-precision plants. IT MAKES PRECISION GAGING EASY . . . at machine . . . at inspection bench . . . for selective assembly. No other like it—investigate and see why.

COMTOR CO.
69 Farwell St.
Waltham 54, Massachusetts

GET THE FULL FACTS — REQUEST BULLETIN 48
USE READER SERVICE CARD; INDICATE A-2-254-2



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when only a diamond tool will do the job...

ASCO *has the answer!*

- Specialists in diamonds and diamond tools for industry since 1908. Skilled in recognizing and selecting the right diamond for the right tool • Highest standards of quality—control in all manufacturing operations • *Manufacturers*—diamond tools, wheels, drill bits • *Importers and dealers*—carbons, bortz, balas.

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USE READER SERVICE CARD; INDICATE A-2-254-3

USE OF "HARTFORD SPECIAL" DRILL UNITS

INCREASES PRODUCTIVITY 211.7%

CUTS COST PER PART 32%

Processing cast iron pivot yokes for a major appliance manufacturer posed a problem for Woodruff & Edwards. The major headaches were:

1. The part was being milled, drilled, faced and turned on four separate machines.
2. Production per 8 hour shift was 600 parts, but required more than two men who consumed 22 manhours.
3. The scrap figure was very high.
4. Cost per part was high.
5. Loss and delay in handling were high.

Woodruff & Edwards solved the problem by designing and building their own production machine around four standard "Hartford Special" Air-Hydraulic Drill Units. The successful results:

1. Now in one machine, four holes are drilled, two spotfaced, one boss hollow milled, spotfaced and chamfered, another boss chamfered and a shoulder spotfaced and chamfered.
2. Production per shift is still 600 parts but requires only 8 manhours, an increase in productivity of 211.7%.
3. ***Not one yoke in over 100,000*** delivered to the customer ***has been rejected.***
4. A saving of 32% per part has been realized, including a recent rise in cost of material!
5. Parts are now handled by one man and are shipped directly to the assembly line of the customer with a minimum of delay.

PETE LENART, Dept. Foreman, says, "This is a very efficient operation with practically no machine maintenance. The setup is extremely compact because the Hartford Drill Units are space saving, and easy to install, too."

RICHARD HAMPEL, a Supt. of Woodruff & Edwards who helped design the machine says, "We have achieved a fine record on this job, and the Hartford Drill Units deserve the lion's share of the credit."

Take a tip from the Woodruff & Edwards story. Let "Hartford Special" Drill Units and other standard components bring higher production at lower cost to your plant.

MACHINE TOOL DIVISION

THE HARTFORD SPECIAL MACHINERY CO.

280 HOMESTEAD AVE., HARTFORD 12, CONN.

HARTFORD *Special*

NOW... the expanded line of KENDEX* Tooling

meets broad range of job requirements

The ever increasing demand for Kendex tooling is indicative of the wide application of the Kendex principle to all types of machines: turret lathes, engine lathes, planers, milling machines, and automatic cycling machines. To meet this growing demand, Kennametal† has more than doubled the number of sizes of Kendex toolholders, and now offers a complete line of inserts for all holders and job requirements. This expanded line now includes:

- **17 Kendex holder styles and 101 different tool sizes in a rugged, simple, trouble-free design . . . proven on a broad range of applications**
- **a wide selection of standard nose radii (non-standard radii also available at slight added cost)**
- **a complete line of Kennametal inserts for all job requirements . . . to fit all tool holders now in use**

Thus, Kennametal now offers the exact style of Kendex tooling you need . . . positive or negative rake holders: square, triangular, round or heavy duty inserts with correct nose radii for use with your present holders. Regular inserts (ground top and bottom only) and precision inserts (all surfaces ground) are stocked in a broad range of grades.

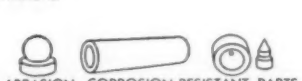
Why not discuss your tooling problems with a Kennametal tool engineer and let him show you how Kennametal tooling can provide the right answer on any machining job. Or write to KENNAMETAL INC., Latrobe, Pennsylvania.

*Registered Trademark; Patent applied for †Registered Trademark

A-9423

Give your machines the tools they deserve . . . the BEST

INDUSTRY AND
KENNAMETAL
...Partners in Progress



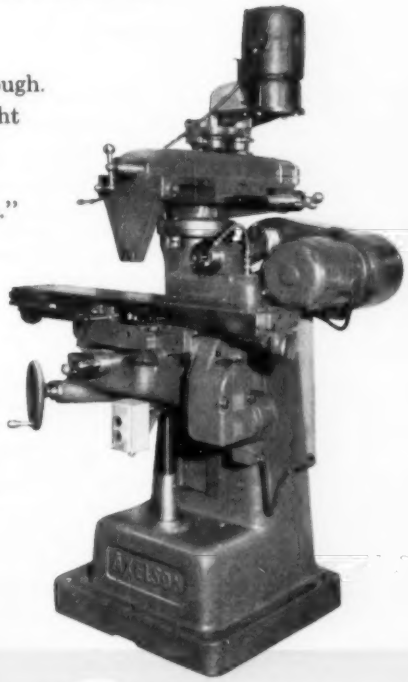
"machine work is our bread and butter... that's why we like the AXELSON MILL"

Josef F. Klingler, with his partner George M. Jansen, operates the Janler Plastic Mold & Die Co. in Chicago.

"We make plastic molds on a contract basis. Some jobs are rough, tolerance-wise, others not so tough. We can put the rough ones on the Axelson, work right from the lead screws and we can believe the dials. We use our Axelson a lot on cavity milling and jig bore with it too. It's accurate and fast—easy to use."

"We get paid for results and that's how we judge a machine. I know there are bigger, more elaborate machines on the market. Let's just say the Axelson is a lot of machine for the money."

An Axelson 10RH Duplex Milling Machine. Catalogs on this and on other Axelson milling machines will be sent to you on request.



AXELSON
MILLING MACHINES
make man hours mean more

Producers of the World famous Axelson Lathe

AXELSON MANUFACTURING COMPANY
DIVISION OF U. S. INDUSTRIES, INC.
6160 S. BOYLE AVENUE, LOS ANGELES 58, CALIFORNIA • Dealers in Principal Tool Centers of the U. S.

Tough grinding jobs?

Check Vulcanaire high speed precision grinding heads!

Grinding circular slot using Vulcan's Rotary Table and Magnetic chuck.

Many seemingly impossible grinding problems have been solved by adapting Vulcanaire to standard machines or by using one of Vulcan's specially designed machines.

On Surface Grinders, merely remove wheel and guard, clamp vertical or horizontal adaptor to machine as illustrated. No belts necessary. For instance, Vulcanaire used in connection with Vulcan's Rotary Table for Surface Grinders permits the grinding of a circular slot.

Vertical adaptor for Surface Grinders. Grinding small slots

Adaptors are in stock to fit the spindle of Vertical Milling Machines for grinding contours, holes and slots.

On Internal Grinding Machines Vulcanaire's infinitely controlled speeds furnish the correct surface cutting speed resulting in faster production and micro finish. The adaptor sleeve fits into present housing.

Applied to Jig Boring Machines, Vulcanaire is liked by leading precision manufacturers because its accuracy is guaranteed, producing Vulcanaire jig grinding of large and small parts.

Horizontal application. Grinding a shoulder Punch.

Send us a blue print on your toughest grinding problem. Recommendations and sketches will be returned to you — no obligation.

Major Vulcan Services

Engineering, Processing, Designing and Building... Special Tools... Dies . . . Special Machines . . . Vulcamatic Transfer Machines . . . Automation . . . including the Vulcan Hydraulics that Form, Pierce, Assemble and size. . . . Vulcanaire Jig Grinders . . . Motorized Rotary Tables . . . Plastic Tooling.

VULCAN TOOL CO.

7300 LORAIN AVENUE • DAYTON 10, OHIO

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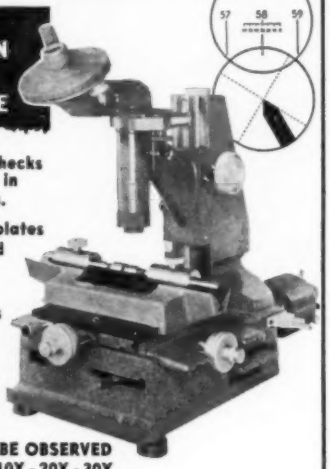
NEW LEITZ TOOLMAKER MICROSCOPE

...PRODUCES HIGHEST PRECISION ....CUTS INSPECTION TIME



The NEW LEITZ DESIGN checks angular measurements in degrees and minutes.

Contains all Thread Templates for U. S. National thread profiles 6-80 pitch.

Contains Radii Templates from 21/64" to 13/16" by 1/64". Concentric circles from .010" to .280" by .010" and one blank compartment.

NOTE: TEMPLATES CAN BE OBSERVED IN 3 MAGNIFICATIONS: 10X - 20X - 30X

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Originators and Manufacturers of Helical Reamers and End Mills

Helical Taper Pin Reamers Shipped by Return Mail

The

GAMMONS-HOAGLUND

Company

400 Main Street, Manchester, Conn.

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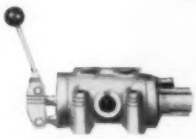
"Why is it easy to plan Hydraulic Circuits using RIVETT VALVES?"

COMPLETE LINE



Hand, Foot, Cam, Solenoid, Pilot Operated

Sub-Plate Mounted, Solenoid, Pilot Operated

Flow Control, Check, Deceleration, Relief, Unloading, Sequence, Counter-Balance

1500-3000 P.S.I. | PISTON DESIGNS FOR ANY CIRCUIT

Sizes: 1/4", 3/8", 1/2", 3/4", 1", 1-1/4", 1-1/2"

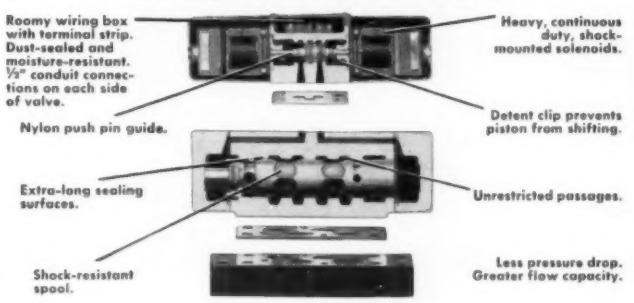
Actions: Standard, Spring Return, Spring Centered, Ball Detent

EXPERIENCED DISTRIBUTORS

"1st — Rivett's 190 standard models give me more latitude in engineering a circuit. This wide selection permits choosing the right type of valve for a more economical and efficient operation."

"2nd — My Rivett Distributor is experienced in hydraulic design. With his help I have been able to plan better operating systems."

QUALITY CONSTRUCTION


Roomy wiring box with terminal strip. Dust-sealed and moisture-resistant. ½" conduit connections on each side of valve.
Heavy, continuous duty, shock-mounted solenoids.
Nylon push pin guide.
Detent clip prevents piston from shifting.
Extra-long sealing surfaces.
Unrestricted passages.
Shock-resistant spool.
Less pressure drop. Greater flow capacity.

Sub-Plate Mounted, Solenoid, Pilot Operated Valve

INFORMATIVE LITERATURE

"3rd — I can count on longer life as well as the rated performance of Rivett Valves. They are designed and built for accurate circuit control."

"4th — Rivett valve catalogs are complete with specifications and drawings. Write for #204 and #260."

RIVETT LATHE & GRINDER, INC., DEPT. TE-2, BRIGHTON 35, BOSTON, MASSACHUSETTS

RIVETT furnishes a complete power package

AIR AND HYDRAULIC — VALVES, CYLINDERS, POWER UNITS

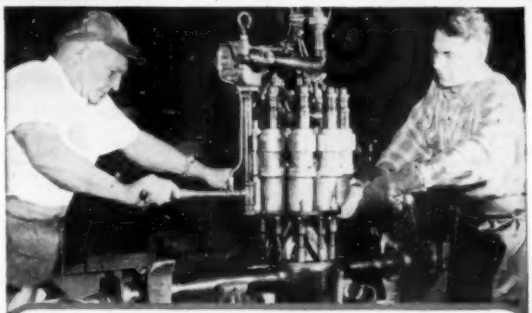
See Rivett Valves at Booth 324, ASTE Show, Chicago, March 19-23

Fast, Accurate Nut Setting with MULTIPLE SPINDLES

Multiple nut setters bolt down cylinder heads in automobile engine assembly. Torque output of each spindle is individually adjustable.

Where bolts or nuts can be run and tightened two or more at a time, Keller Multiple Nut Setters increase output and reduce costs. Even more important, they improve quality control by keeping torque within very close tolerances.

The automotive industry—and many others—are making extensive use of these tools. For detailed information contact your nearest Keller sales office. Descriptive Bulletin 16-101 sent free on request.



Ten bolts are run simultaneously to attach axle carrier to differential housing. Accurate torque is vital because the joint must be leakproof.

GARDNER - DENVER

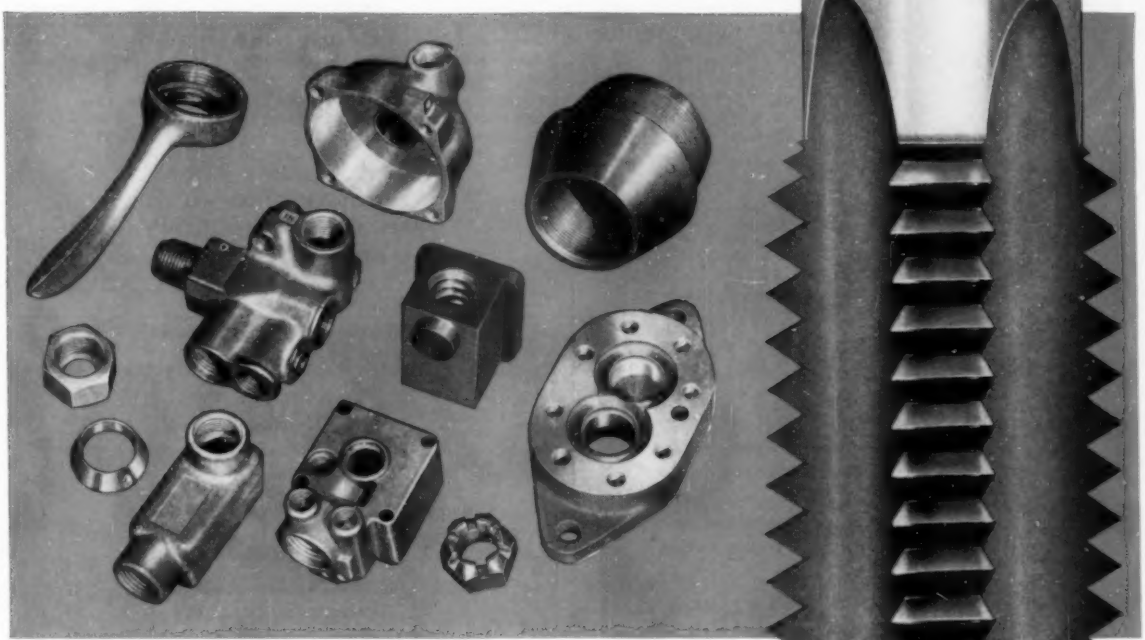
KELLER TOOL division, Grand Haven, Michigan

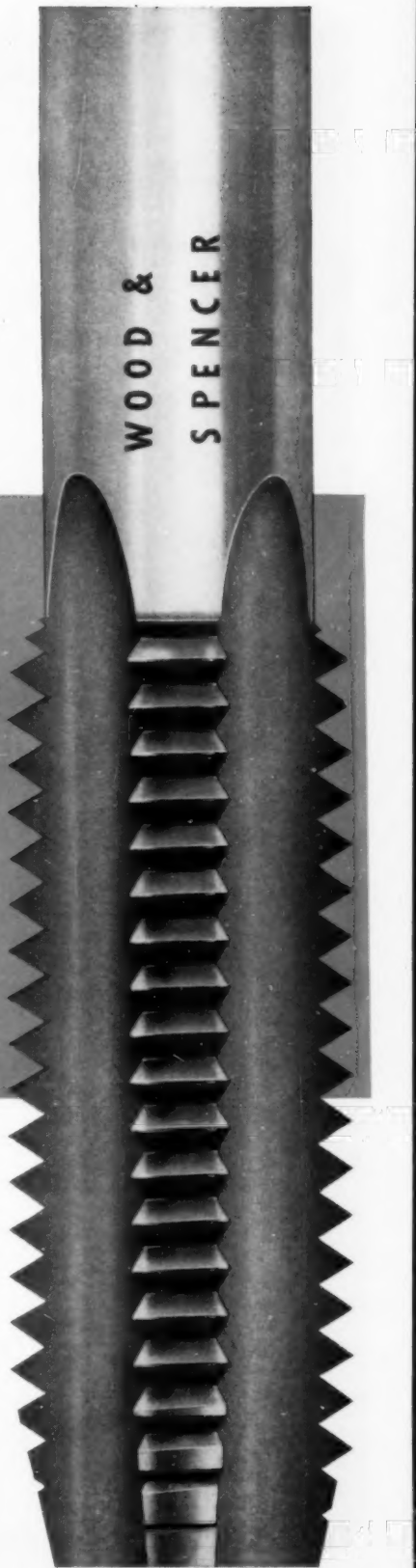
THE QUALITY LEADER IN COMPRESSORS, PUMPS, ROCK DRILLS AND AIR TOOLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

Wood & Spencer

TAPS

...Solve Difficult Tapping Problems





On routine jobs, tapping isn't much of a problem today. No matter whose taps you use, they are all about equally precise . . . and do a good threading job.

But, you may run into trouble on especially difficult tapping jobs. In fact, the picture above shows examples of tapping troubles we have solved, and which our customers considered difficult. In practically every case we have recommended practices which have resulted in substantial savings for our customers on their tapping operations.

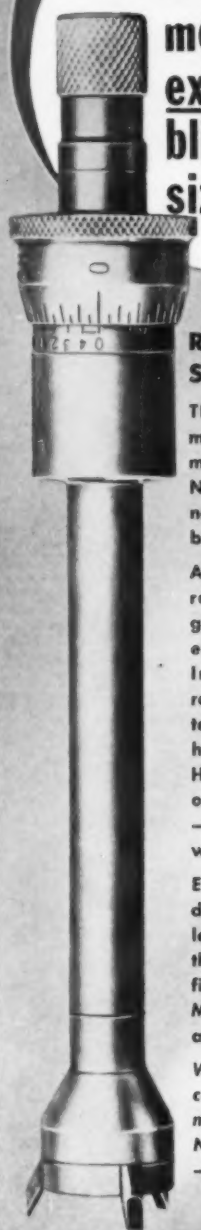
We have many other examples on file, and we'll be glad to help you solve *your* problem if you'll call us.

Want a free tap guide: Everyone who has one finds this handy wall chart an excellent ready-reference. It tells all standard gage tolerances, class fits and tap tolerances. Write us for one on your business letterhead.

The Wood & Spencer Company • Cleveland 3, Ohio

Etalon INGAGE

measures the exact bore or blind hole size



Reading: .0001"
Sizes: 3/16" to 1.6"

This unique new precision measuring instrument will take measurements of blind holes. No masters or setting rings needed — measures *directly* — by .0001".

Automatically aligns in holes, rectangular contact points guarantee extreme accuracy even when fully extended. Immediately detects out of round holes. Extensions facilitate accurate measurements of holes up to 6 feet in depth. Hardened contact points exert only 11 oz. measuring pressure —will not damage even fragile work.

Exceptionally easy to read, deep clean-cut graduations laid out on a large diameter thimble. Dull chrome plated finish. Furnished in English or Metric graduations, individually or in sets.

WRITE FOR CATALOG on complete line of precision measuring instruments: VERNIER CALIPERS—MICROMETERS —DIAL INDICATORS

ALINA

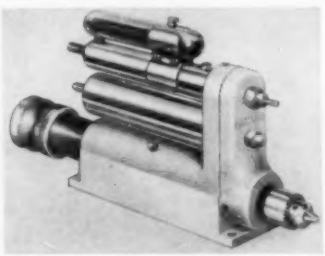
ALINA CORPORATION
401 Broadway, New York 13, N.Y.

USE READER SERVICE CARD; INDICATE A-2-262-1

NEW LYNMATIC 101 DRILL HEAD

with Transparent Hydra-Control Reservoir

A precision drilling unit, engineered for extreme versatility and rugged simplicity with only four moving parts. The air feed drilling head has many features including an adjustable hydraulic feed control that permits accurate constant feeds anywhere between stop and 200 feet per minute with rapid traverse to the work.



Featuring a newly-designed transparent hydra-control reservoir which establishes an open system that eliminates the captured air problem and also permits visual check on hydraulic fluid.

Although it can be used with any three or four way valves, the Lynmatic 101, when used in conjunction with the Lynco automatic Control Box CB-1 and Lynco Cycle Timer will perform varied operations to automatically drill holes properly up to ¼-inch diameter in almost any material.

Sides and bottom are machined square and parallel to the spindle to close tolerances to simplify alignment. A base width of 2 inches permits drilling to 2-inch centers with a 2-inch stroke.

LYNCO INC.
National Distributors
BURKLYN COMPANY
3429 Glendale Blvd. • Los Angeles 39

USE READER SERVICE CARD; INDICATE A-2-262-2

WORLD'S HARDEST METAL

BUSHINGS
BLADES
ROLLS
TOOLS
DIES
BAR STOCK
IMPROVED QUALITY
Additional refinements and improvements in our process have added still longer life to the wearing edges of Talide tools, dies and wear resistant parts. The result is a carbide having a new, unique grain structure with harder and tougher properties than previous grades. Laboratory tests reveal our improved grades possess 25% greater strength and rigidity. Service life per grind up to 50% longer than previous grades has been proven in grueling field tests.
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HOT PRESSED AND SINTERED CARBIDES · VACUUM METALS
HEAVY METAL · CERMETS · HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

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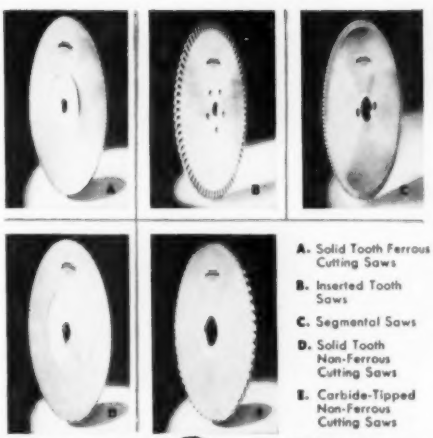

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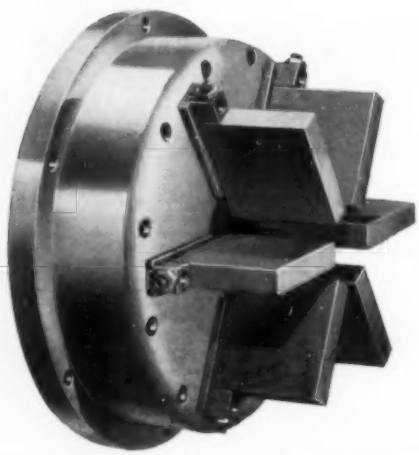

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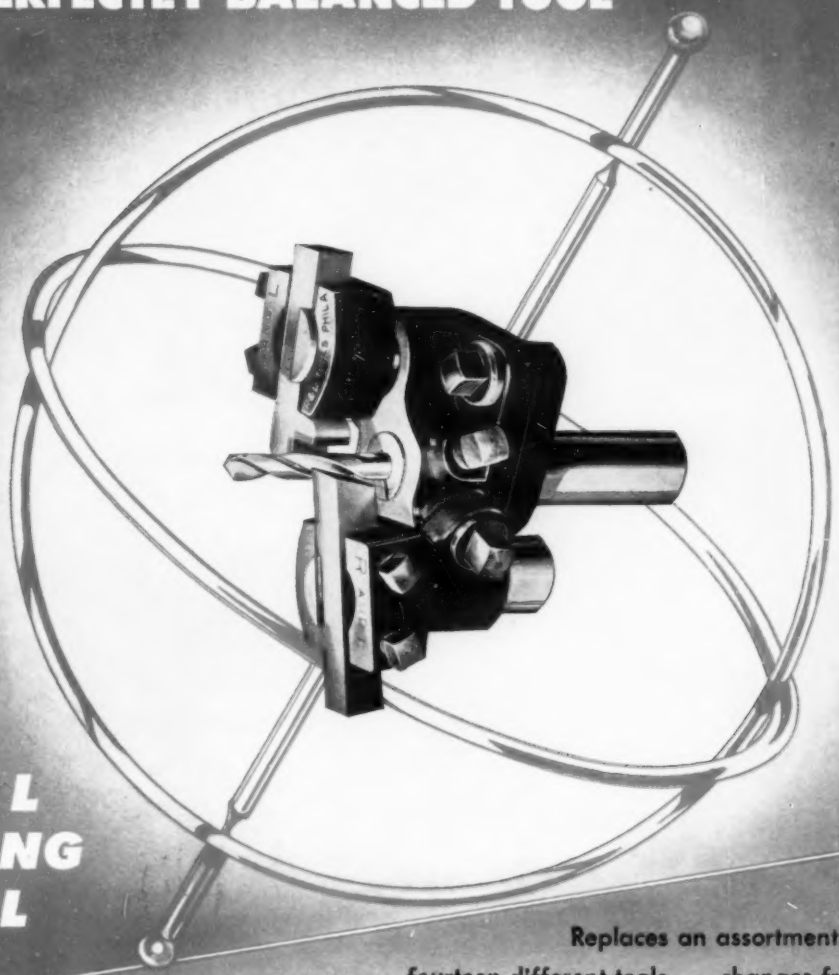

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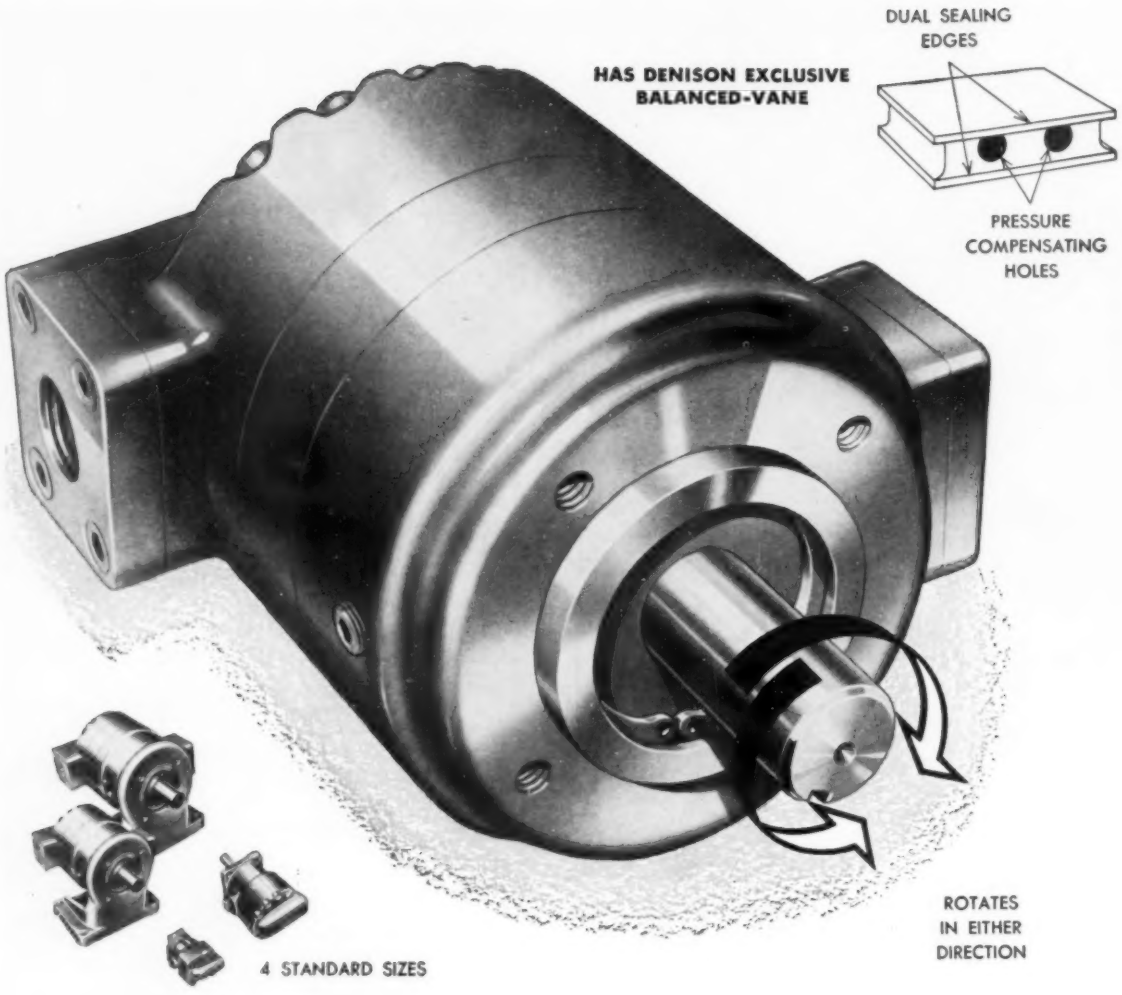

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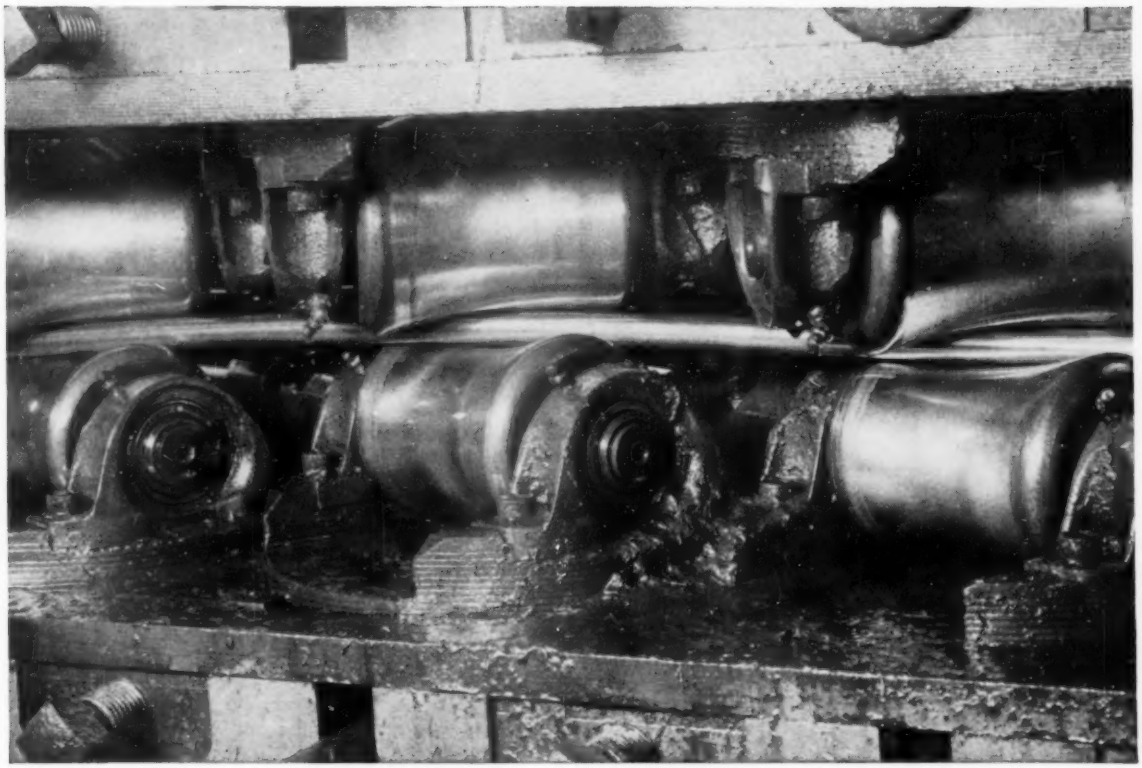

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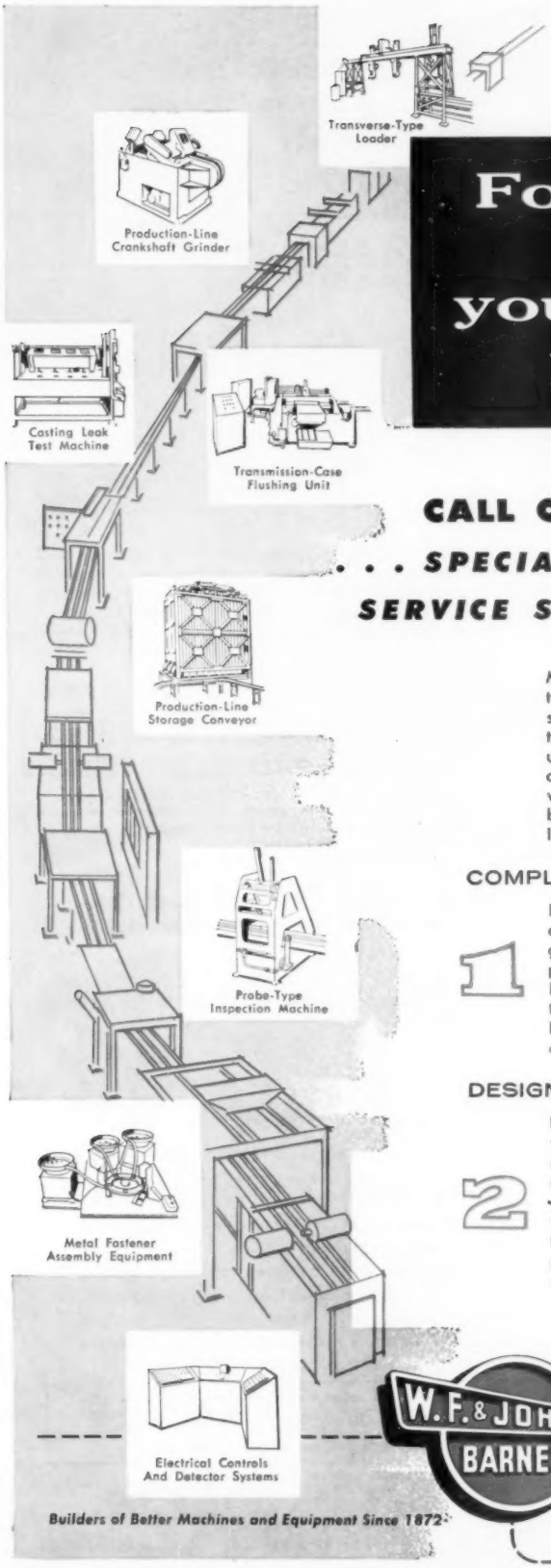

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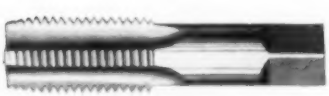

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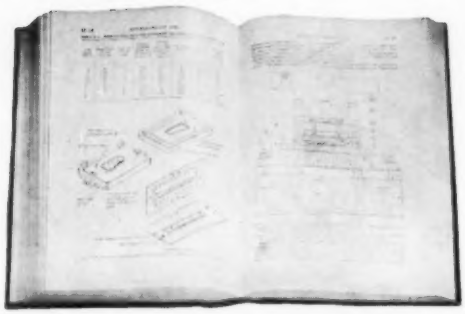

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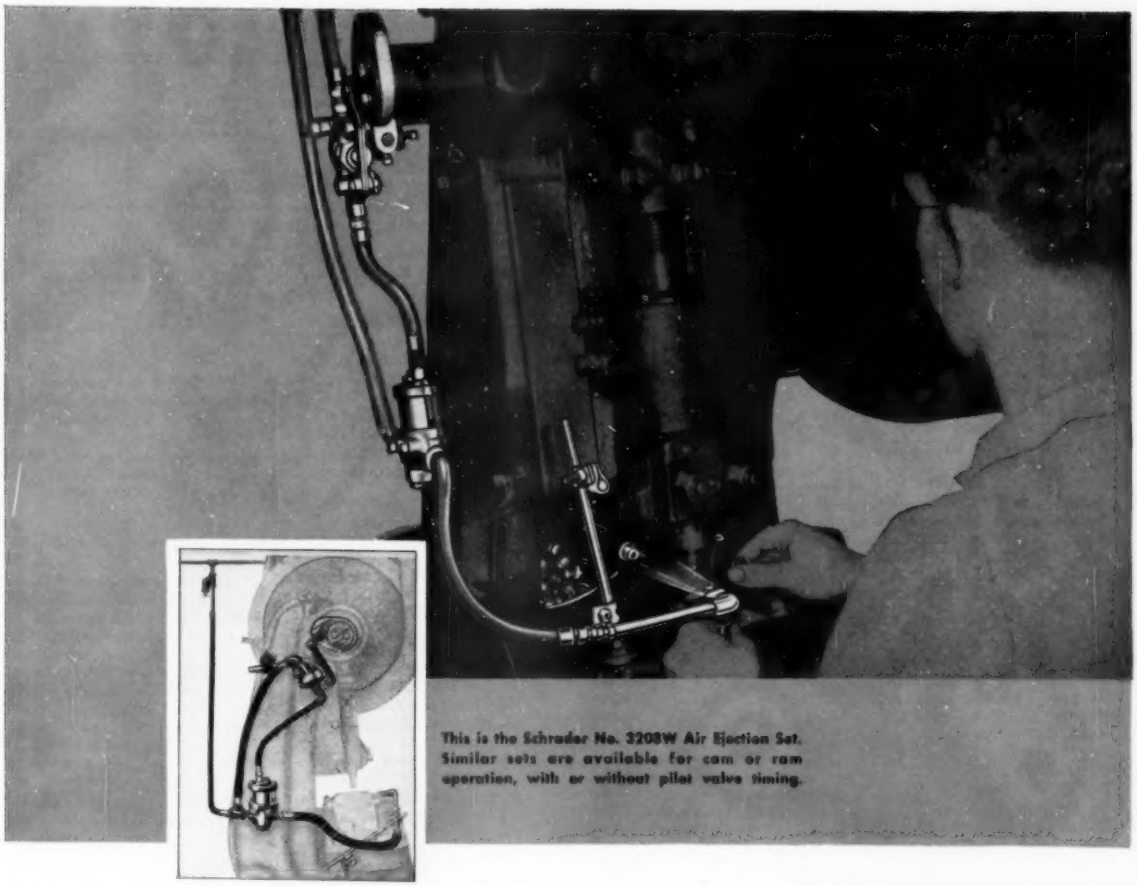

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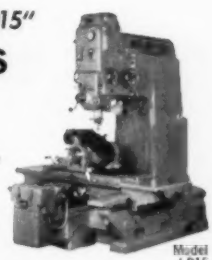

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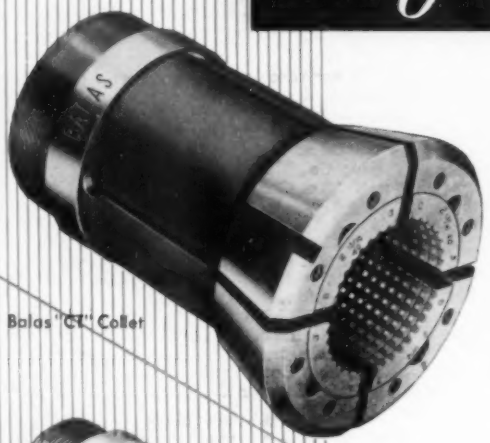
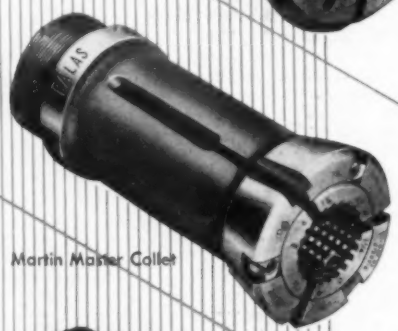


Balas "CT" Collet



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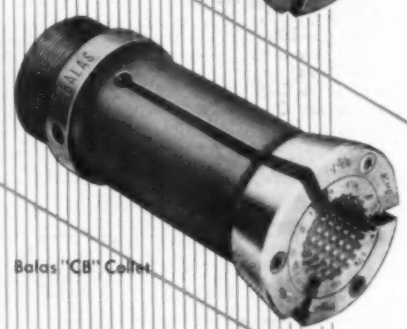

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On medium and short runs you don't need a solid collet for each size bar stock. Buy Balas Master Collets and assorted sets of pads so you can make full use of the capacity of your machines. You save money since a set of pads is about a third the cost of a solid collet of comparable capacity. Such savings mean money in your pocket.

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Balas Master Collets are stocked in most sizes for all popular makes of automatics and are guaranteed against breakage for one year. They are available up to 8" capacity. Order them today and get better production at lower cost from all your machines.

THE BALAS LINE INCLUDES: Master Collets and Pads • Pushers and Feed Fingers • Master Pushers and Pads • Ejector Collets • Conventional Collets • Carbide-faced Stock Stops for B. & S. Machines • Collet Sleeves and Chuck Nuts for B. & S. Machines

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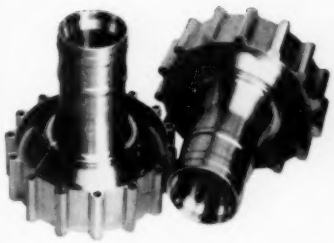

There's a first-cost advantage when your Bor-Dril operation can be done on a Standard Ex-Cell-O Machine. This Style 112-D Precision Boring Machine is Bor-Drilling 14 holes from the solid on the part shown above.

Short Cut in Long Hole Drilling

EX-CELL-O'S BOR-DRIL METHOD

Bor-Dril is a new cost-reducing way to drive gun drills. It makes possible high production with accuracy on long holes from solid, maintaining finish size. Also it finish-machines cored holes in castings in one operation. Since its recent introduction by Ex-Cell-O, Bor-Dril is saving money on many newly developed applications. Range of hole sizes is large, and the process takes widely varied sizes and shapes of parts made of steel, cast-iron, bronze, aluminum, magnesium and titanium. For more information on Bor-Dril, or for a quotation on a machine equipped for this work, call in your local Ex-Cell-O Representative or contact Ex-Cell-O in Detroit.

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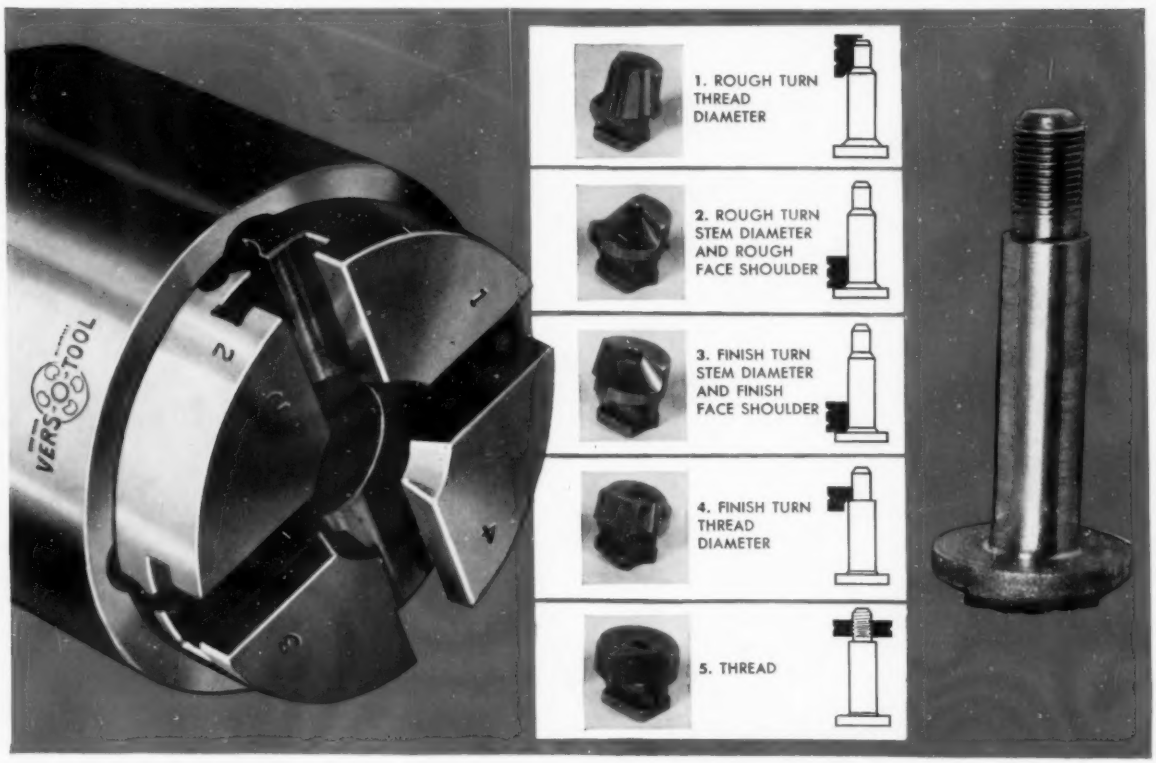
HERE'S HOW NAMCO VERS-O-TOOL

CUTS COSTS... SPEEDS PRODUCTION ON END TURNING AND FORMING

In this application 300 lever supports an hour are turned out on a vertical six-spindle automatic. Vers-O-Tool machines these steel forgings three times faster than single point tools, opens at the end of the cut, leaves no spiral marks on the work.



Vers-O-Tool licks tough production problems because:

1 Basic Vers-O-Tool design permits cutters or ground thread chasers to be changed quickly without adjustment in the head.

2 All settings in the blocks are made in the tool-room with a micrometer gauge—no need for trial and error run after changing or grinding.

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